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DECEMBER 1957

THURSTON SCOTT WELTON, M.D., EDITOR

Symposium on Maxillofacial Surgery

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DECEMBER 1957

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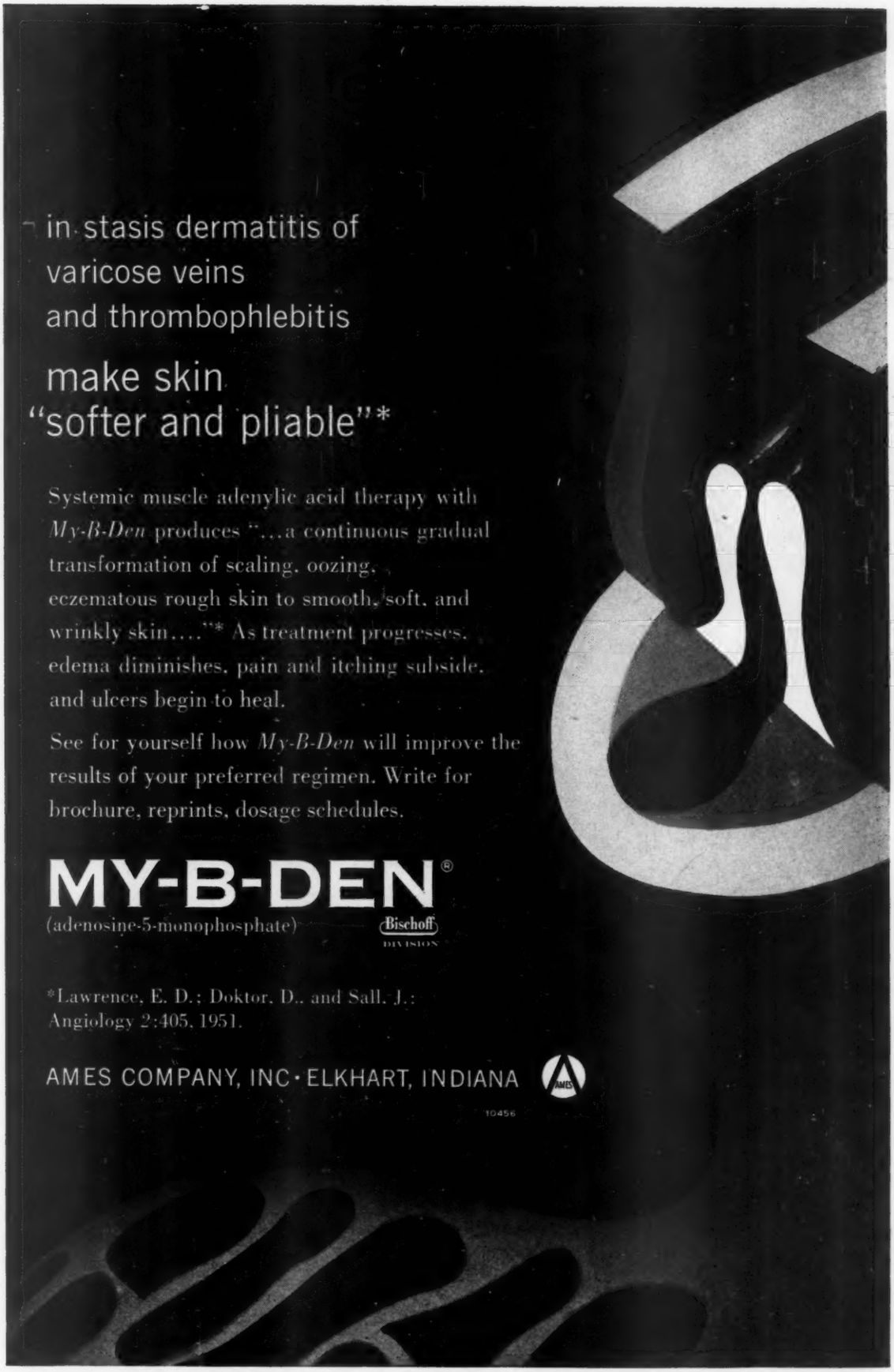

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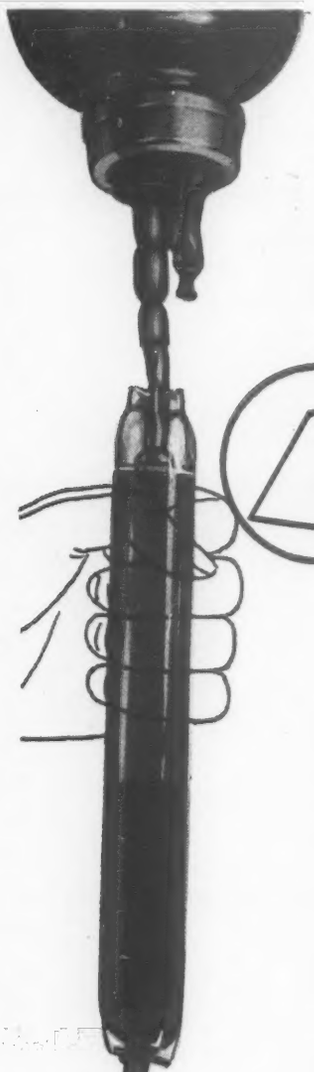

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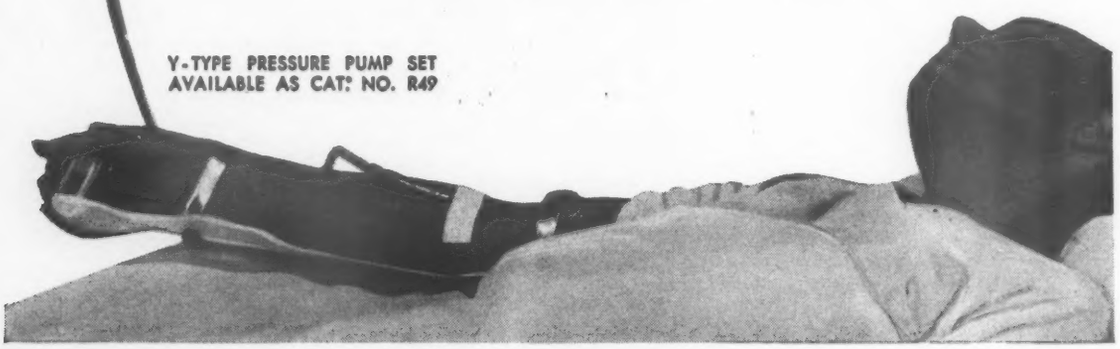

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JACQUELINE SIEGRIST

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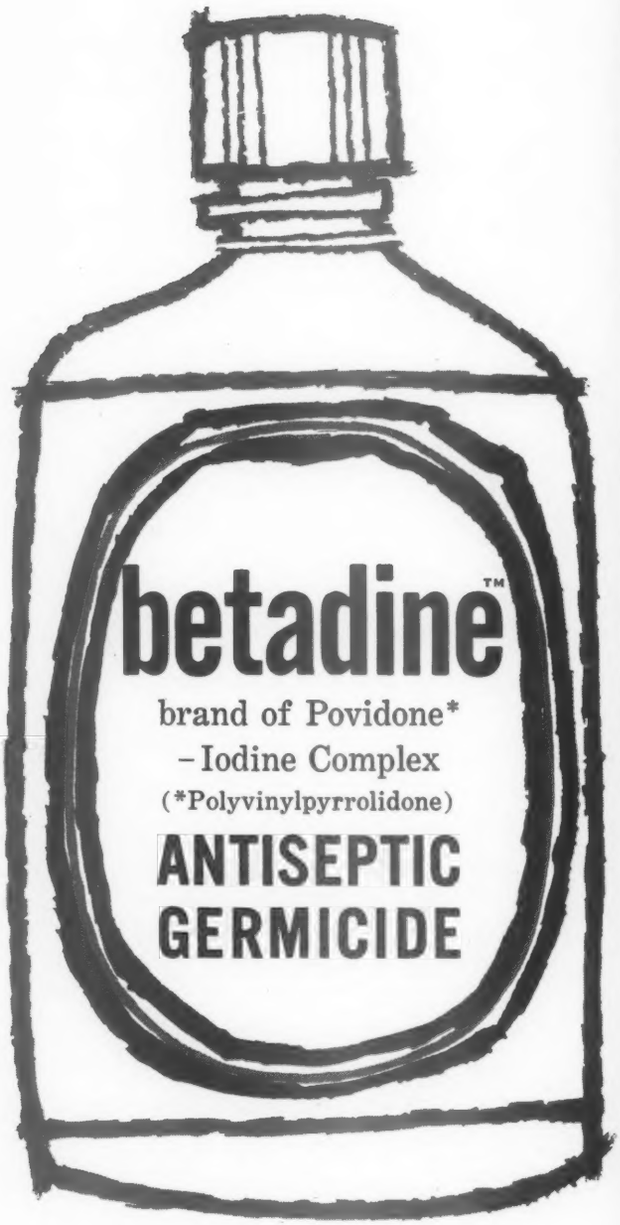
The Bactericidal Properties of Iodine with Minimal Toxicity, Sensitization or Primary Irritation



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method has been in use over thirty years. Two hundred forty-four patients underwent operations from 1935 to 1951. The majority of the 302 patients treated for acute perforated ulcer (1933 to 1955) were submitted to surgery before the advent of antibiotics and before knowledge of fluid and electrolyte balance had become fully developed. Hence the total lethality seems high. A sane and instructive review.

Subtotal Gastrectomy in the Treatment of Peptic Ulcer. Evaluation of 220 Cases 920

JACK WELCH AND V. E. CHESKY

Among 220 patients (average age of 53.6 years) with benign peptic ulcer, who were subjected to subtotal gastrectomy (1943 to 1955), three suffered proved recurrences. There were five operative deaths. A follow-up consisting of personal interviews and questionnaires showed that 90.1 per cent of the patients had a satisfactory result, 5.2 per cent a fair result, and 1.5 per cent resulted in failure. The results obtained demonstrate that subtotal gastrectomy is a valuable procedure for benign peptic ulcer requiring surgery.

Improper Reduction of Fractures of the Proximal Phalanges of Fingers 926

TIMOTHY A. LAMPHIER

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Lipoma of Sigmoid 931

WALTER A. D'ALONZO

A discussion of the historic, etiologic, aspects of colonic lipomas pathologic and symptomatologic. Lipoma of the large intestine is second in frequency in benign lesions. A case of lipoma of the proximal sigmoid colon is reported with resection and subsequent recovery of the patient.

Povidone-Iodine As a Topical Antiseptic 938

LOUIS GERSHENFELD

The author discusses povidone-iodine as the iodine preparation of choice and as an antiseptic for the skin and mucous membranes. Experiments performed, with the technics and findings, are listed.

MODERN OPERATIVE TECHNIC

Osteoplastic Reconstruction in Severe Fractures of the Tibial Condyles. Utilization of the Anterior Superior Iliac Spine 940

HAROLD G. LEE

A preliminary report describing an operative method for the treatment of the severely depressed and comminuted fracture of the tibial condyle. Two illustrative cases are reported.

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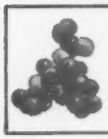

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1. *Rushia, E. L.: Preliminary report on the use of meprobamate for pre-anesthetic sedation. J.M.A. Georgia* **46**:*93, March 1957.*
2. *Lamphier, T. A.: The role of meprobamate in postoperative surgical care. Ann. New York Acad. Sc.* **67**:*810, May 9, 1957.*
3. *Kern, E. C.: Preoperative sedation with meprobamate (Miltown) in surgery of eye, ear, nose and throat. Eye, Ear, Nose & Throat Month.* **36**: *408, July 1957.*

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CASE REPORTS

Abscess of the Spleen 945

LT. COL. THOMAS J. WHELAN, JR.

The author presents a case of splenic abscess following total colectomy for idiopathic ulcerative colitis. The choice of operation (splenotomy vs. splenectomy) is discussed. Emphasis is placed on the roles of antibiotic therapy as an adjunct to, but not a substitute for, surgery in the treatment of this condition.

Dysgerminoma of the Ovary 951

ROBERT E. MCCURDY AND KENNETH C. SAWYER

A case of dysgerminoma of the ovary in a three and a half year old child is reported. A metastatic lesion in the neck was the presenting symptom. The primary tumor was diagnosed several months later. Treatment is discussed.

Pheochromocytoma 955

WILLIAM C. STAINBACK AND FREDERICK R. ROBBINS

A report of the history, symptoms and various tests that led to a diagnosis of pheochromocytoma. In the case presented herein the patient was followed up for two years. Her symptoms were totally relieved. Apparently this tumor is the largest of its type seen to date.

Retention of a Pulmonary Segment Following Interruption of the Bronchus, Artery and Vein 959

JOHN W. BELL

The survival of a pulmonary segment following complete surgical interruption of the bronchus, pulmonary artery and vein is reported. This is unusual. It is questionable if such a procedure has been performed before as a deliberate operative maneuver.

Omphalocele 963

GILMAN D. KIRK

A report of a case of omphalocele, a ventral and a scrotal hernia, in a male baby. Immediate surgery is the rule in this rather rare condition. Technic of operations and postoperative treatment (important) are discussed.

Hypernephroma in a Child. 966

MILTON E. KLINGER AND VENICIO M. DE LEON

This is a case presentation of an unusual tumor of the kidney in a young boy. The presenting symptom of gross hematuria was found ultimately to be due to a small renal cell carcinoma. At operation a well circumscribed cortical tumor was found. The microscopic picture suggests a possible origin of the tumor in renal adenoma.

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Fat Embolism in Childhood. Review and Case Report 970

JAMES BYRON CARTY

A case of fatal fat embolism (a rare condition) in a seven year old obese child is presented, together with a review of the general subject.

Congenital Absence of the Septum Pellucidum. A Review of the Literature with Case Report 974

JAMES R. ST. JOHN AND DAVID L. REEVES

A case of absence of the septum pellucidum diagnosed by pneumoencephalography is presented. Forty-five cases of this defect are reviewed. Pertinent information is summarized and tabulated.

Superficial Phlebitis of the Breast. 981

MITCHELL KARLAN AND DONALD W. TRAPHAGEN

A case report of superficial phlebitis of the breast, or Mondor's disease, is presented. This lesion may be mistaken for a malignancy due to the frequency of skin fixation. The lesion is self-limited and resolves without treatment.

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The many thousands of patients successfully treated with Signemycin* over the past year have confirmed the value of this safe and effective antibiotic agent. One further therapeutic resource is thereby provided the practicing physician who is faced daily in office and home practice with immediate diagnosis of common infections and the immediate institution of the most broadly effective therapy at his command, in his continuing task of the ever-extending control over human pathogens.

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Lewis, H. H.; Frumess, G. M., and Henschel, E. J.: Rocky Mountain M. J. *54*:806 (Aug.) 1957.

"Results of treatment with oleandomycin-tetracycline of 50 infections [mostly respiratory] due to resistant organisms and 40 infections [respiratory, skin, urinary infections] due to sensitive organisms are very encouraging. In some of these patients, [Signemycin] was lifesaving, and in others surgery was made unnecessary. This confirms other reports."

Shubin, H.: Antibiotic Med. & Clin. Therapy *4*:174 (March) 1957.

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Report on 1404 Cases Treated with Signemycin: Medical Department, Pfizer International. Available on request.

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Levi, W. M., and Kredel, F. E.: J. South Carolina M. A. *53*:178 (May) 1957.

Of 50 patients with various infectious processes, 26 had not responded to previous antibiotic therapy. With Signemycin "Ninety-six per cent of the mixed infections were clinically controlled. . . . and in none of the cases was there any reason to discontinue the drug."

Winton, S. S., and Chesrow, E.: Antibiotics Annual 1956-1957, New York, Medical Encyclopedia, Inc., 1957, p. 55.

Signemycin in 79 patients with severe soft tissue infections: "The average response of these cases was excellent and inflammatory symptoms subsided with almost uniform rapidity....The magnitude and incidence of surgical intervention was reduced....Side reactions were minimal. . . ."

LaCaille, R. A., and Prigot, A.: Antibiotics Annual 1956-1957, New York, Medical Encyclopedia, Inc., 1957, p. 67.

Five groups of patients (total 211) with acne were treated with one of five antibiotic agents, including Signemycin (55 cases). "The results were evaluated taking into consideration the usual response to such conservative conventional therapy and the rapidity of response." In 8 weeks, Signemycin rapidly attained and maintained the highest percentage of efficacy of antibiotic agents tried.

Frank, L., and Stritzler, C.: Antibiotic Med. & Clin. Therapy *4*:419 (July) 1957.

In the treatment of 78 patients with tropical infections, some complicated by multiple bacterial contamination or present for years, Signemycin was found to be "...an exceptionally effective agent," requiring smaller doses and less extended periods of therapy than with the tetracyclines alone, and "caused no notable toxic reactions."

Loughlin, E. H., and Mullin, W. G.: Antibiotics Annual 1956-1957, New York, Medical Encyclopedia, Inc., 1957, p. 63.

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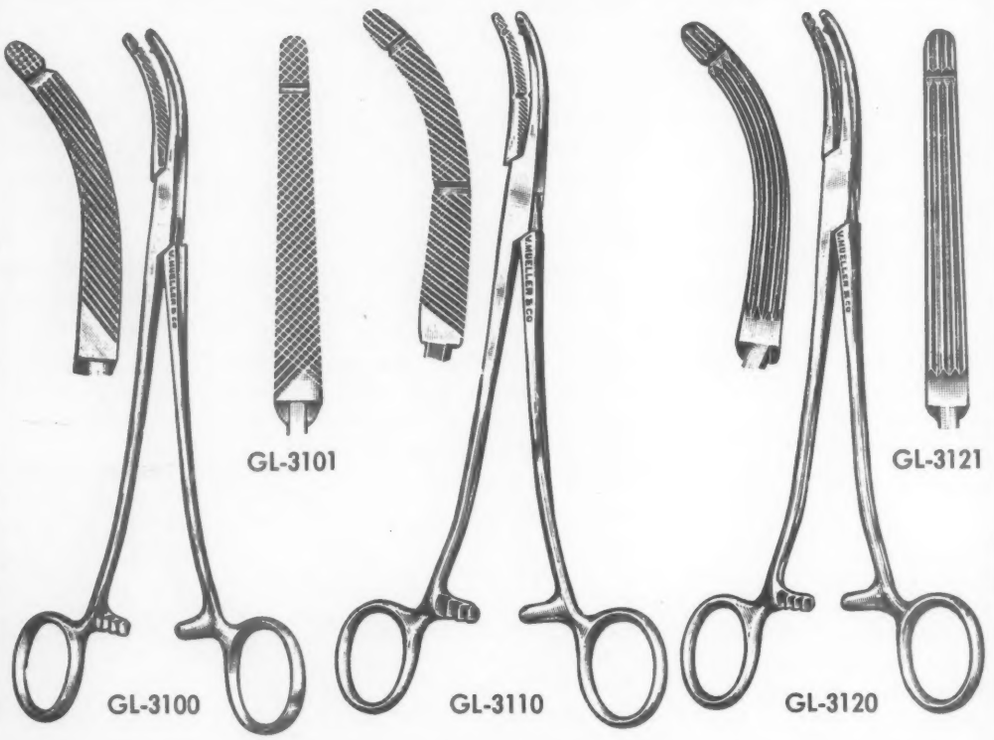

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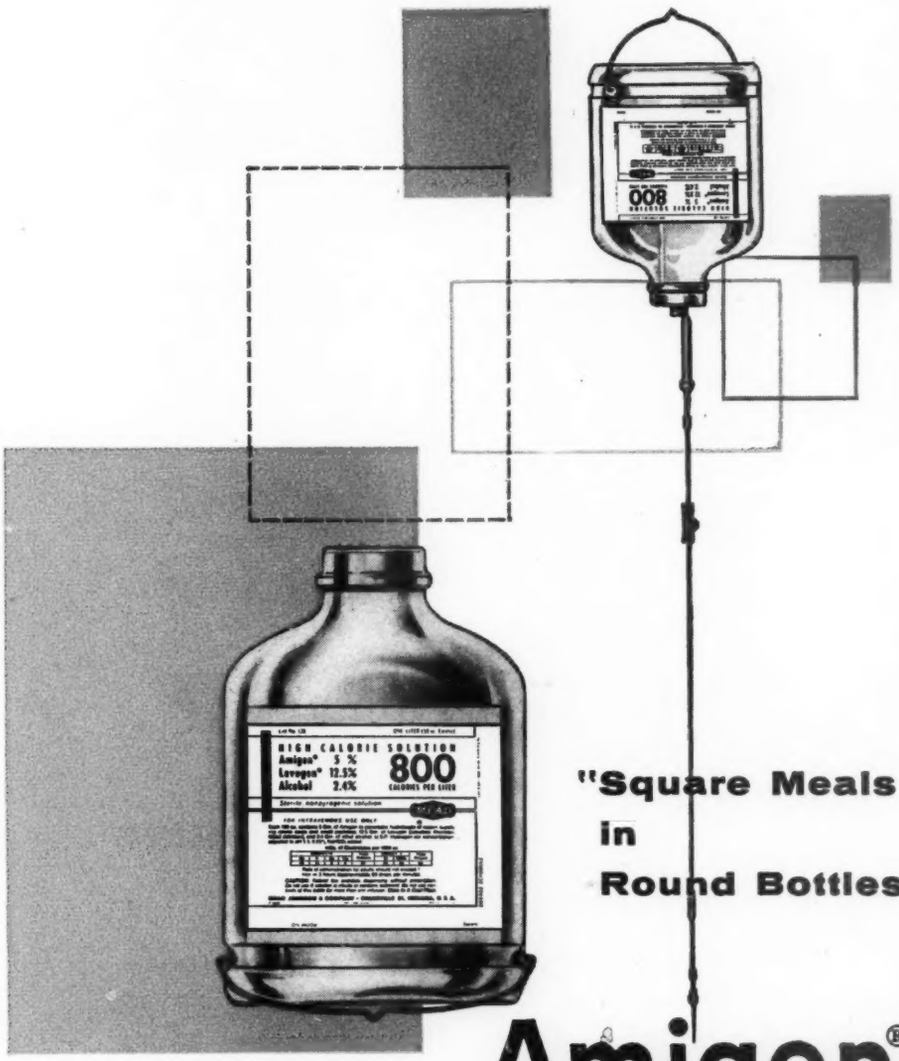

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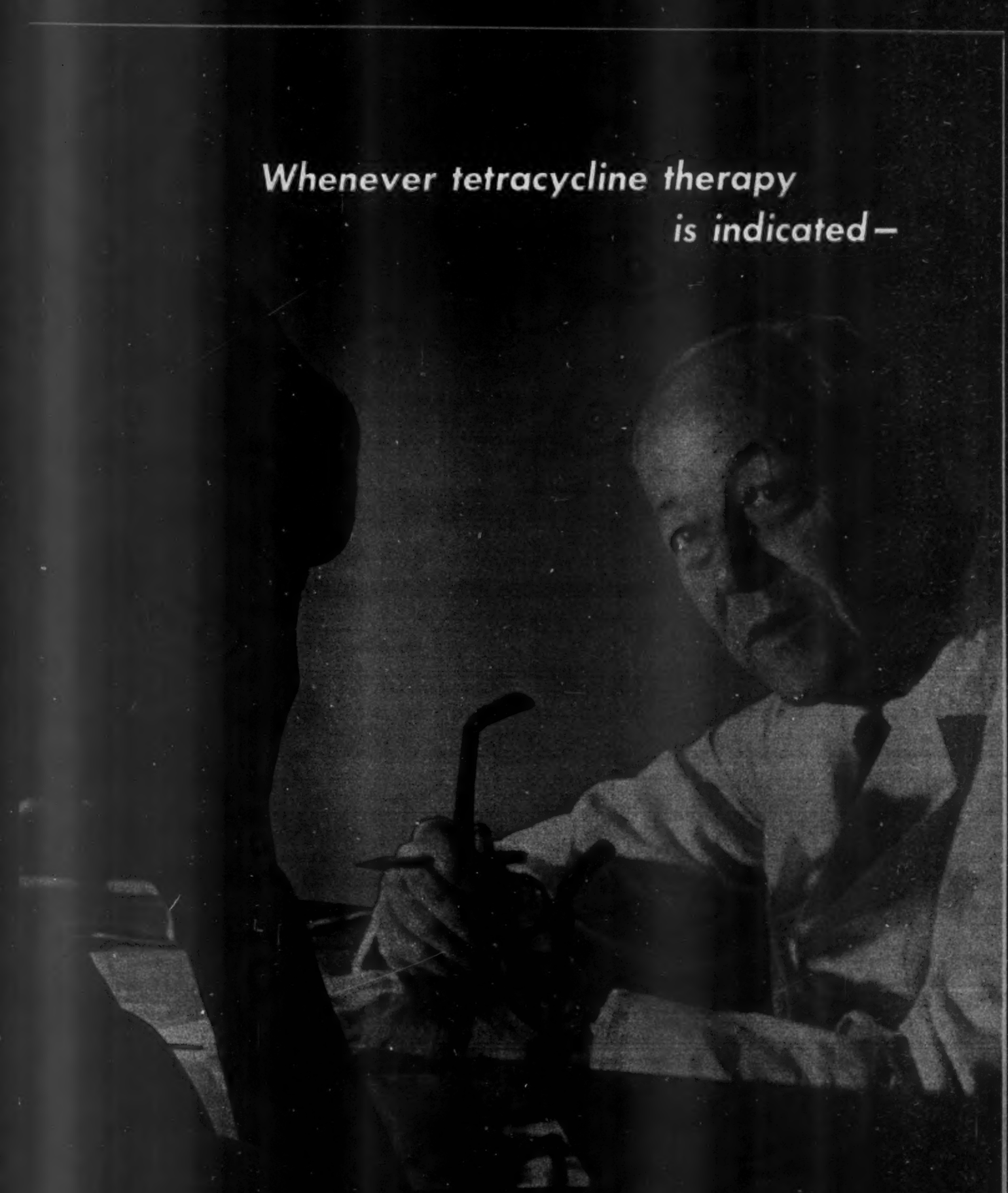

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**® of Astra Pharm. Prod. Inc. for lidocaine*

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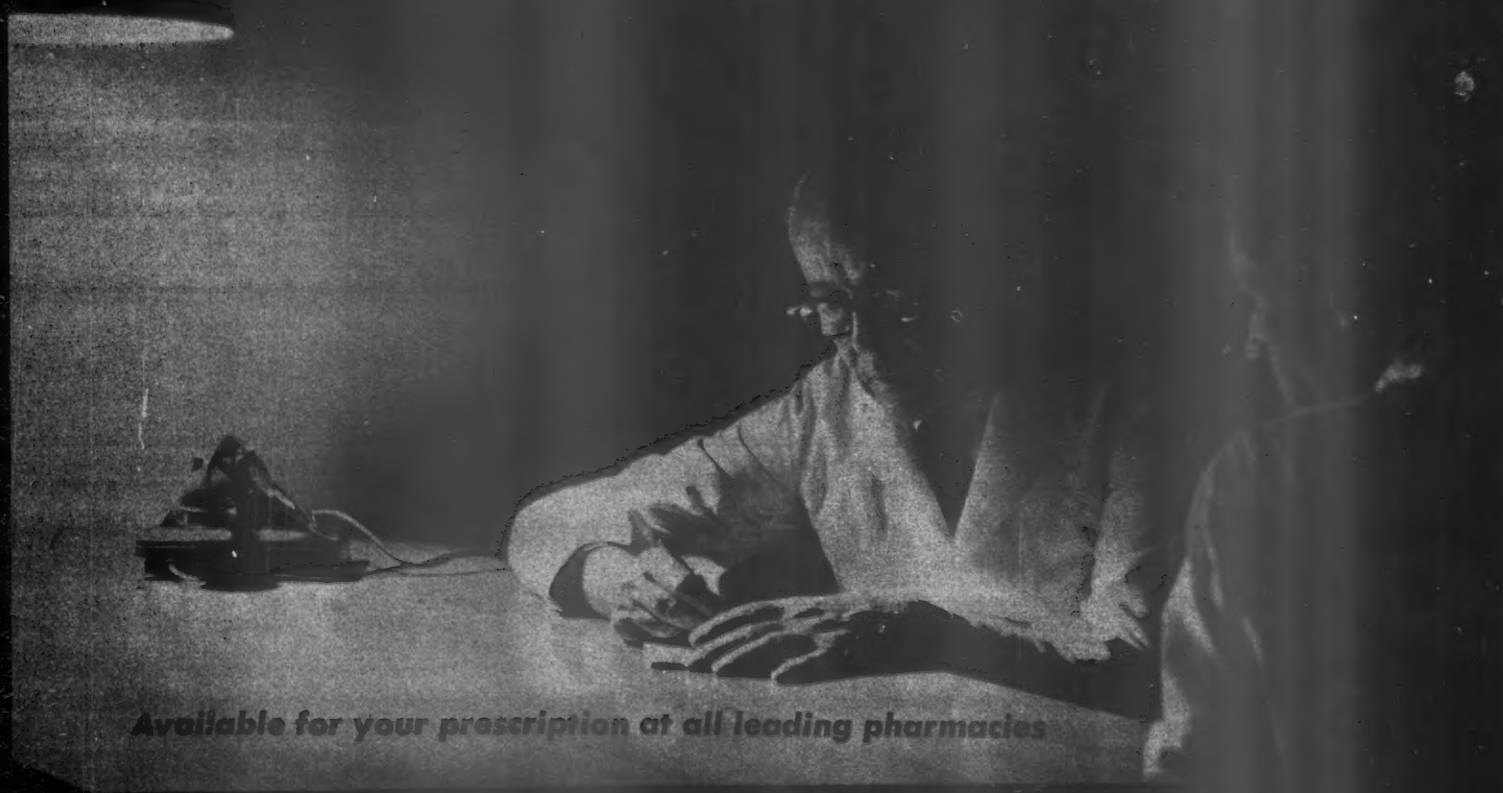

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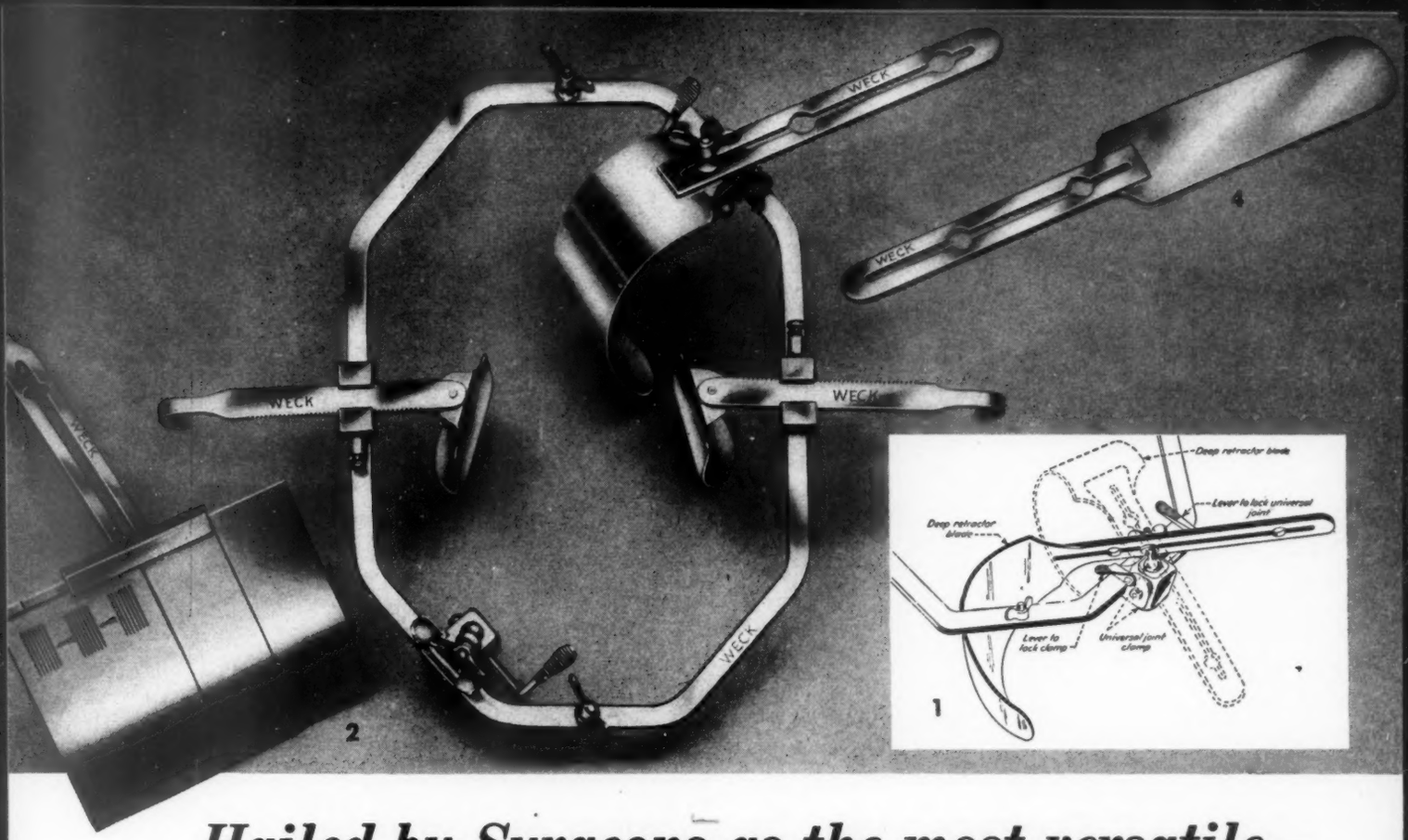

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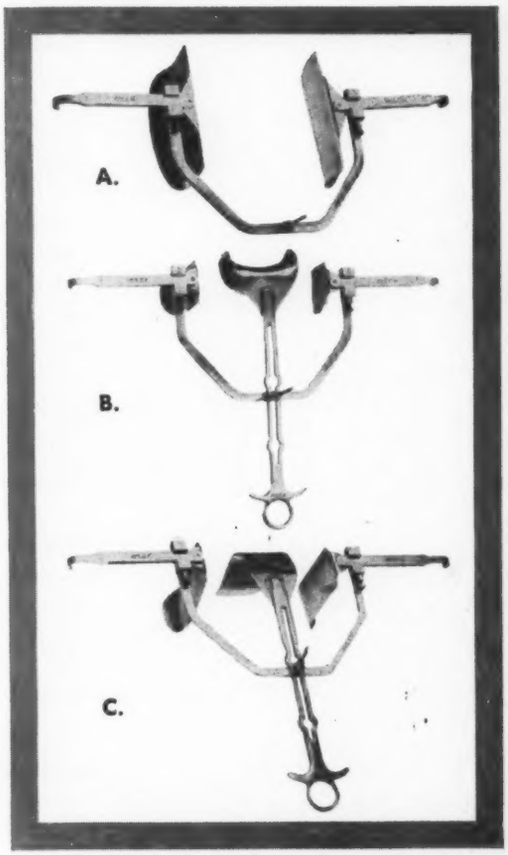

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Reference: 1. Stafford, C. E., Kugel, A. I., and Dederer, A.: *Surg. Gynec. & Obst.* 89:570, Nov. 1949.

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[1] Miller, J. M.; Surmonte, J. A.; Ginsberg, M., and Ablondi, F. B.: Streptokinase Intramuscularly in the Treatment of Infection and Edema. (Scientific Exhibit) *Postgraduate Medicine* Vol. 20, No. 3: 260-267 (Sept.) 1956.

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1. Most patients showed beneficial clinical effect after 24 hours.
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1. An antibacterial drug must be given with the intramuscularly administered streptokinase.
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TREATMENT IS CONSIDERED AT LOWER AGE LEVELS
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Many clinicians advocate therapy with chorionic gonadotropin between the ages of 5 to 7; others suggest instituting treatment at ages ranging from 3 to 14.[1-8] Those practitioners who advocate therapy in early childhood or before puberty do so in the belief that a delay in treatment may result in irreversible aspermatogenesis. In most cases, 10 to 12 years would appear to be an appropriate age to start therapy. In addition, larger doses of chorionic gonadotropin than those formerly employed are now recommended on the basis that these will produce a greater incidence of satisfactory responses.[3]

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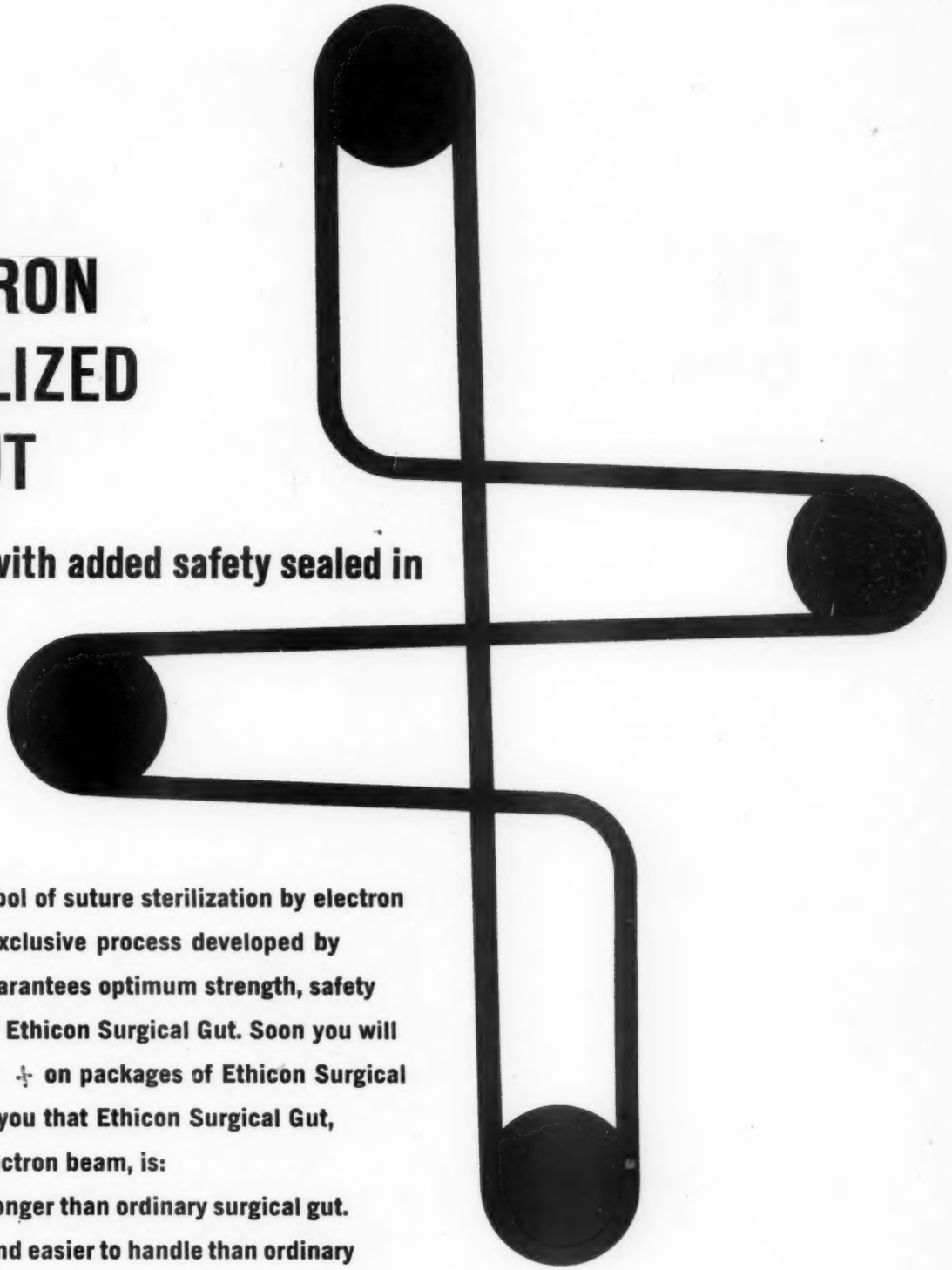

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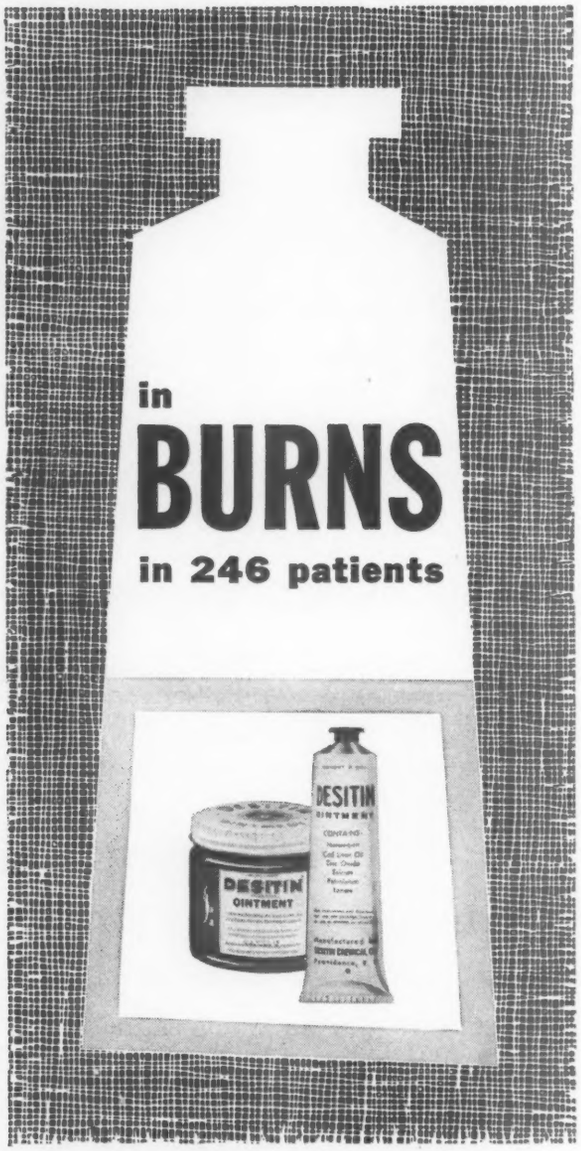

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1. Grayzel, H. G. and Schapiro, S.: Western J. Surg. 64:558, 1956.

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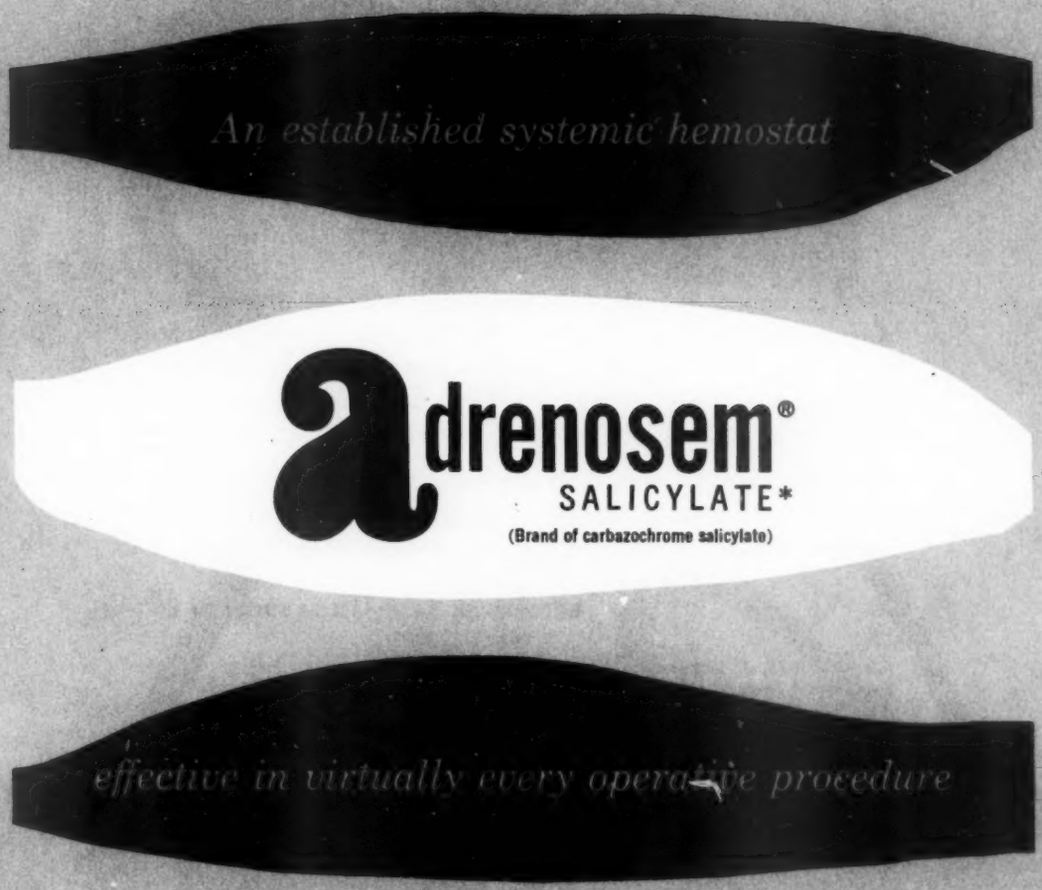

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1. Riddle, A.C., Jr.: Adrenosem Salicylate: A Systemic Hemostat, Oral Surg., Oral Med., Oral Path. 6:617 (June, 1955).

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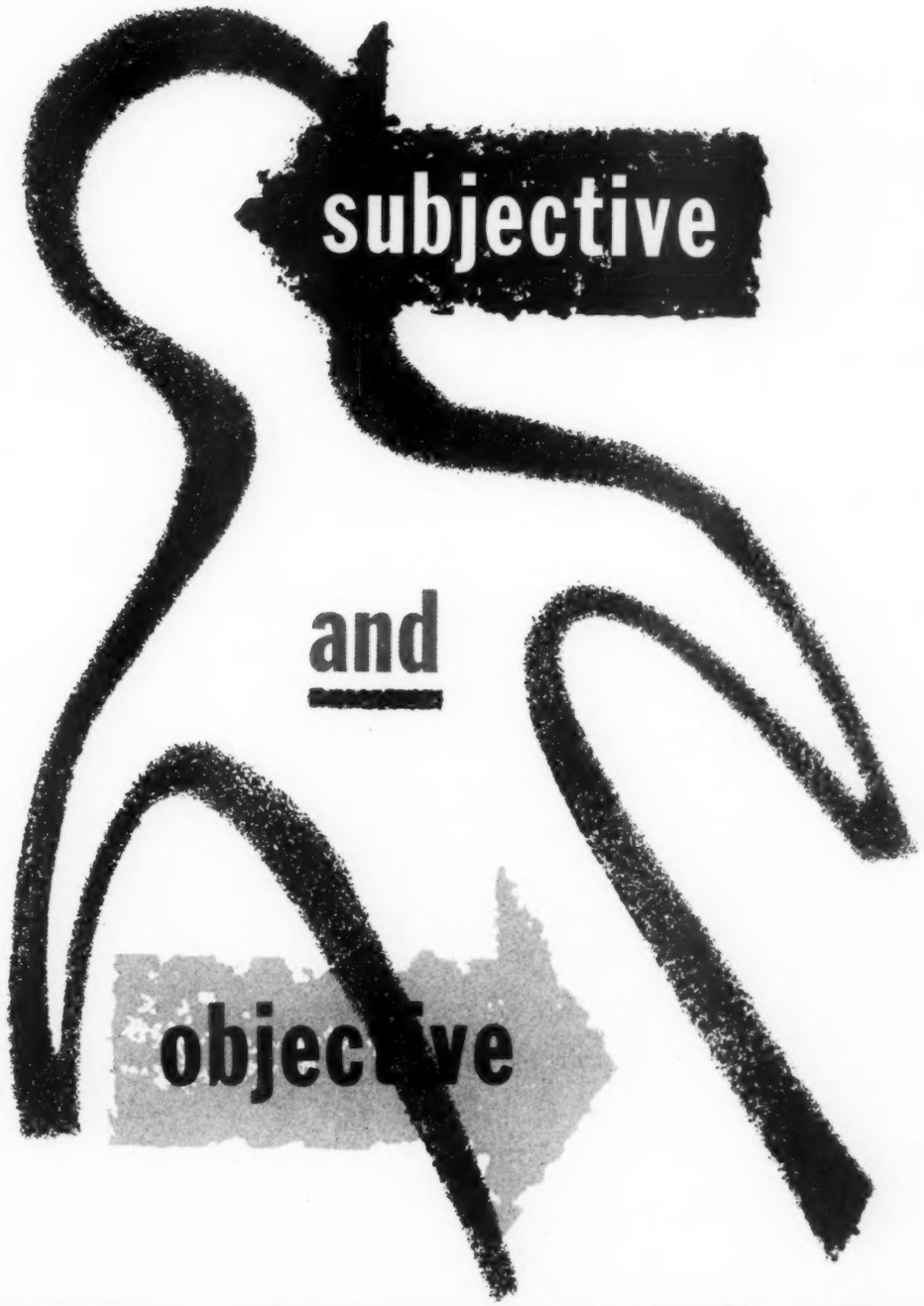

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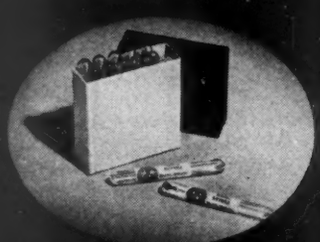

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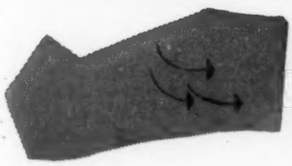

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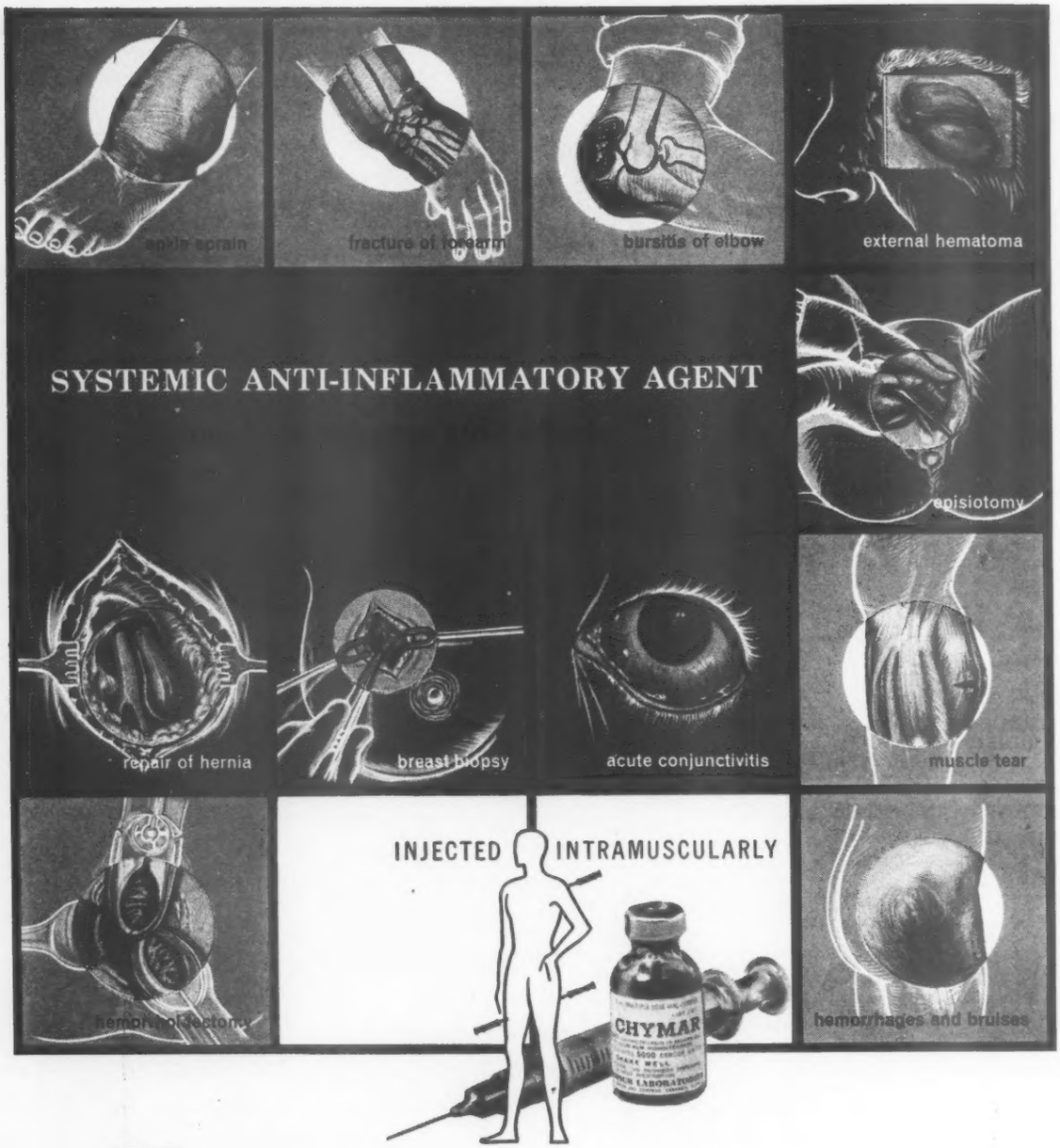

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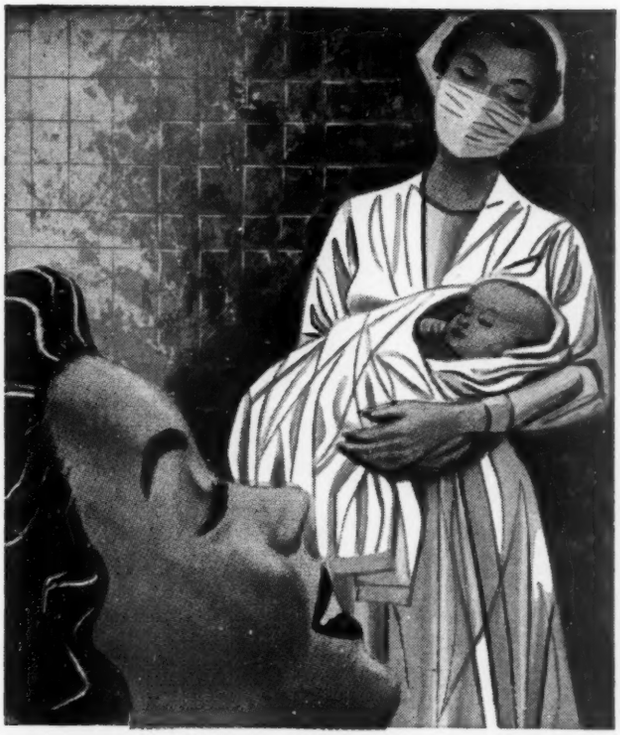

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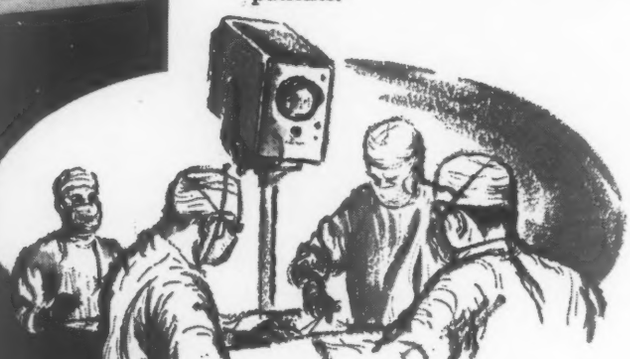

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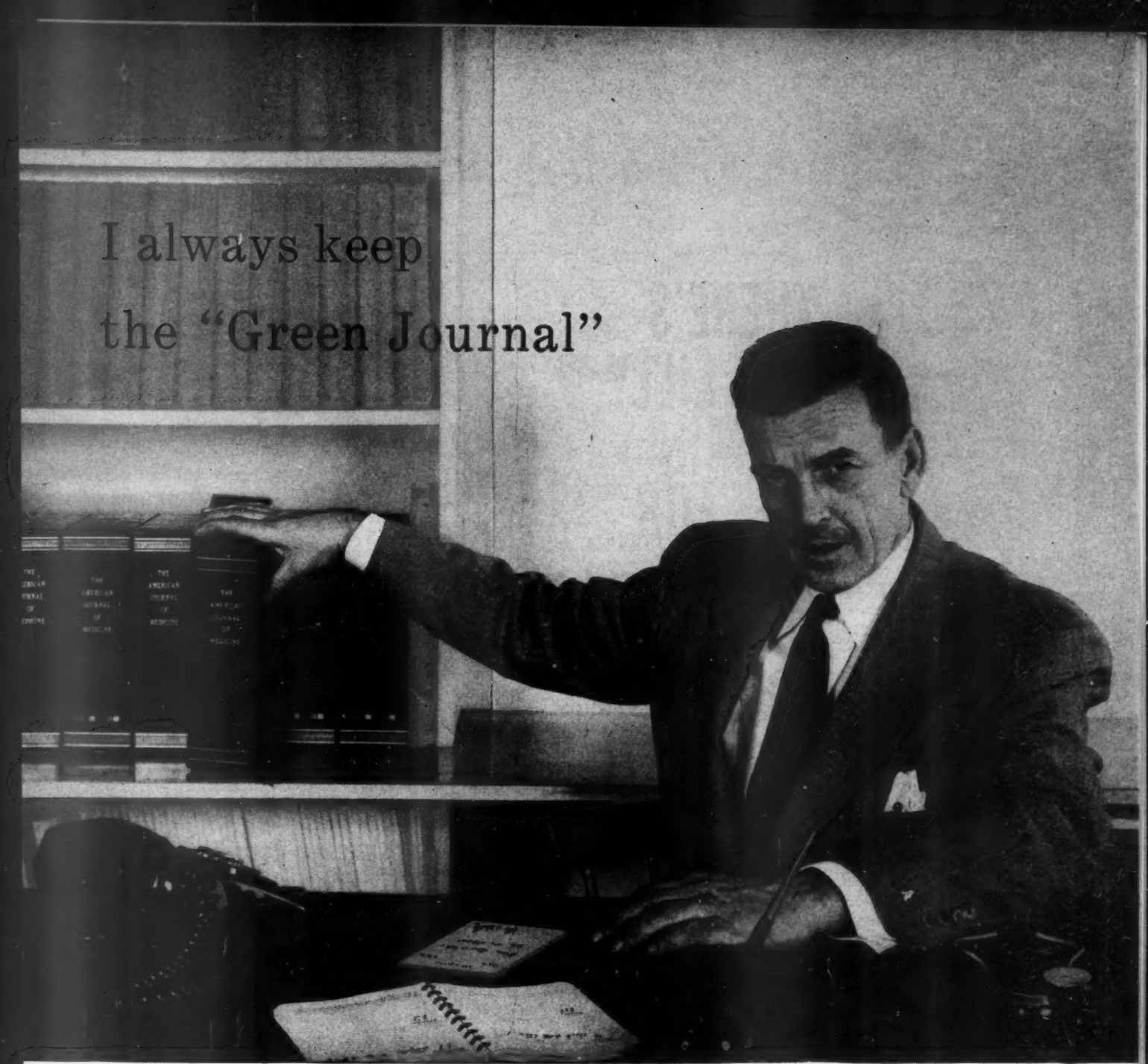

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SYMPOSIUM ON MAXILLOFAICAL SURGERY

A New Surgical Procedure for the Creation of a False Temporomandibular Joint in Cases of Ankylosis by Means of Non-electrolytic Metal

ARTHUR E. SMITH, M.D., D.D.S., SC.D. AND MARSH ROBINSON, M.D., D.D.S., *Los Angeles, California*

THE object of this paper is to present a new surgical procedure in the treatment of ankylosis of the temporomandibular joint. The subject of reconstruction of the temporomandibular joint must necessarily deal with the anatomy and physiology of that structure. It should be kept in mind that the function of the temporomandibular joints is not only that of mastication but also is concerned with deglutition, speech and posture of the head, not to mention the patient's appearance or psychologic attitude toward loss of form or function. The loss of joint function, be it from trauma, infection or other reasons, must be analyzed, as the aim of reconstructive maxillofacial surgery is to restore lost bodily function.

TEMPOROMANDIBULAR JOINT AS CURRENTLY DESCRIBED [*1*]

The bony parts forming the joint are the head of the condyle of the mandible, the mandibular fossa and articular tubercle of the temporal bone. A capsular ligament, thin and loosely arranged, is attached above to the margin of the articular surface, and below is firmly attached to the neck of the condyle. Placed between these two bones is a plate of specialized connective tissue, the articular disc. The external pterygoid muscle originates with two heads: the smaller upper head from the intratemporal surface of the great wing of the sphenoid below the intratemporal crest; the lower head from the lateral surface of the lateral pterygoid plate. The fibers converge backward and laterally to be inserted in a depression in the anterior aspect of the condylar neck and the anterior edge of the disk. In order to make the movements of the mandible a little better understood, a few salient points must be mentioned. The condyle is not in the fossa but on the posterior slope of the articular tubercle. The temporomandibular joint is a hinge joint with a movable socket. All hinge joints have collateral ligaments. In the temporomandibular joint the inner fibers of the capsular ligament form distinct collateral ligaments from the meniscus to the mandible. This means that wherever the mandible goes, the meniscus goes. The upper portion of the external pterygoid muscle inserts into the anterior part of the capsule. In this region the capsule is attached to the meniscus. The lower part of the muscle inserts into the neck of the condyle anteriorly. There is no muscle which can retrude the meniscus *per se*. The physiology is more easily understood when the temporomandibular articulation is regarded as two separate joints: the menisco-condylar joint and the temporomeniscus joint. The only

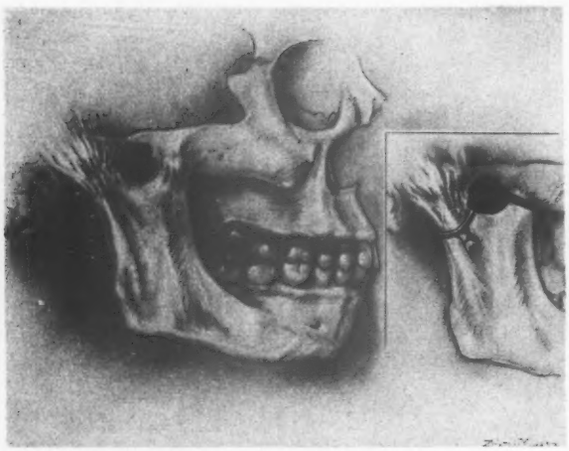

FIG. 1. The schematic drawing of reported case, on the left, illustrates ankylosis due to bone and fibrous tissue in the condylar and coronoid process regions. Drawing on right shows bone and fibrous tissue divided with creation of new hinge joint.

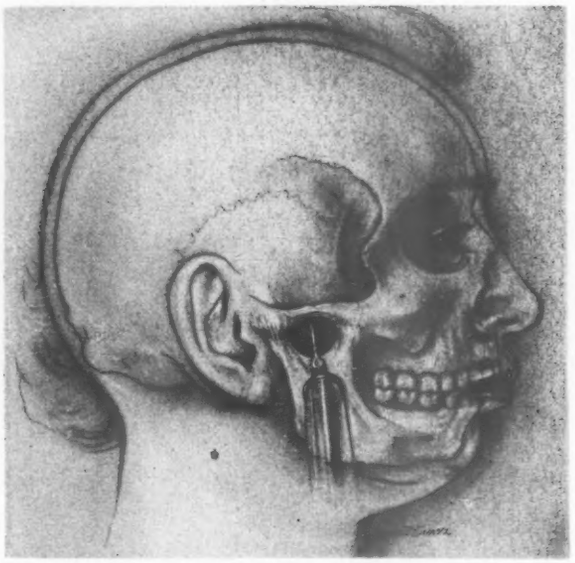

FIG. 2. Schematic drawing showing position of syringe and needle for blocking the third division of the fifth cranial nerve at foramen ovale.

motion that is made or can be made by the menisco-condylar joint is that of opening and closing a purely rotational hinge movement. The temporomeniscus joint is the movable socket of the menisco-condylar joint. The temporomeniscus joint performs all sliding movements and carries the meniscus and condyle to all eccentric positions. This sliding takes place between the meniscus and the posterior slope of the articular tubercle. The condylar growth center plays a vital role in mandibular and facial growth.

ANKYLOSIS

Ankylosis (Fig. 1) comes from the Greek which means a stiffening of a joint. It is a stiffening or fixation of a joint. Bony ankylosis is also termed a true ankylosis or an osseous union between the bones forming the joint. False or fibrous ankylosis is a stiffening of a joint due to the presence of fibrous bands between the bones forming the joint. There are also extra- and intracapsular types of ankylosis. The causes of ankylosis can be congenital, traumatic, infectious or neoplastic. As the mandible is the only bone in the body that articulates in three places with the same bony unit, ankylosis of one temporomandibular joint results in dysfunction not only of that joint but also of the opposite temporomandibular joint and articulation of the teeth. The etiologic factor producing ankylosis usually produces a loss of growth and development of that side of the lower third of the face in patients in the growing stage [2]. It has been noted in our cases that there is a prominent antegonial notch. In normal opening it has been found that the external pterygoid muscle plays the major role by pulling the head of the condyle downward and forward while the hyoid bone is maintained at a constant level. This means that this particular muscle is contracting while the other three muscles, namely, masseter, internal pterygoid and temporal, although controlled by the same nerve, are relaxing. The suprahyoid group tenses only enough to prevent the hyoid from descending. In cases of ankylosis the picture is quite different. It is now found that the patients use the supra- and infrahyoid muscles to a great extent to overcome the increasing ankylosis, and any attempt at opening the jaw demonstrates this function graphically. (Fig. 8.)

MAXILLOFACIAL SURGICAL TREATMENT AS CURRENTLY DESCRIBED

Since the time of Helferich (1893) the major effort in reconstructing the ankylosed mandibular condyle has been to divide the bone and restore motion by the interposition of muscle, fibrous tissue or cartilage between the separated ends of the bone [3]. In dividing the bone, a defect of at least 2.5 cm. must be achieved according to Tholen [4] or a recurrence of the ankylosis is almost certain.

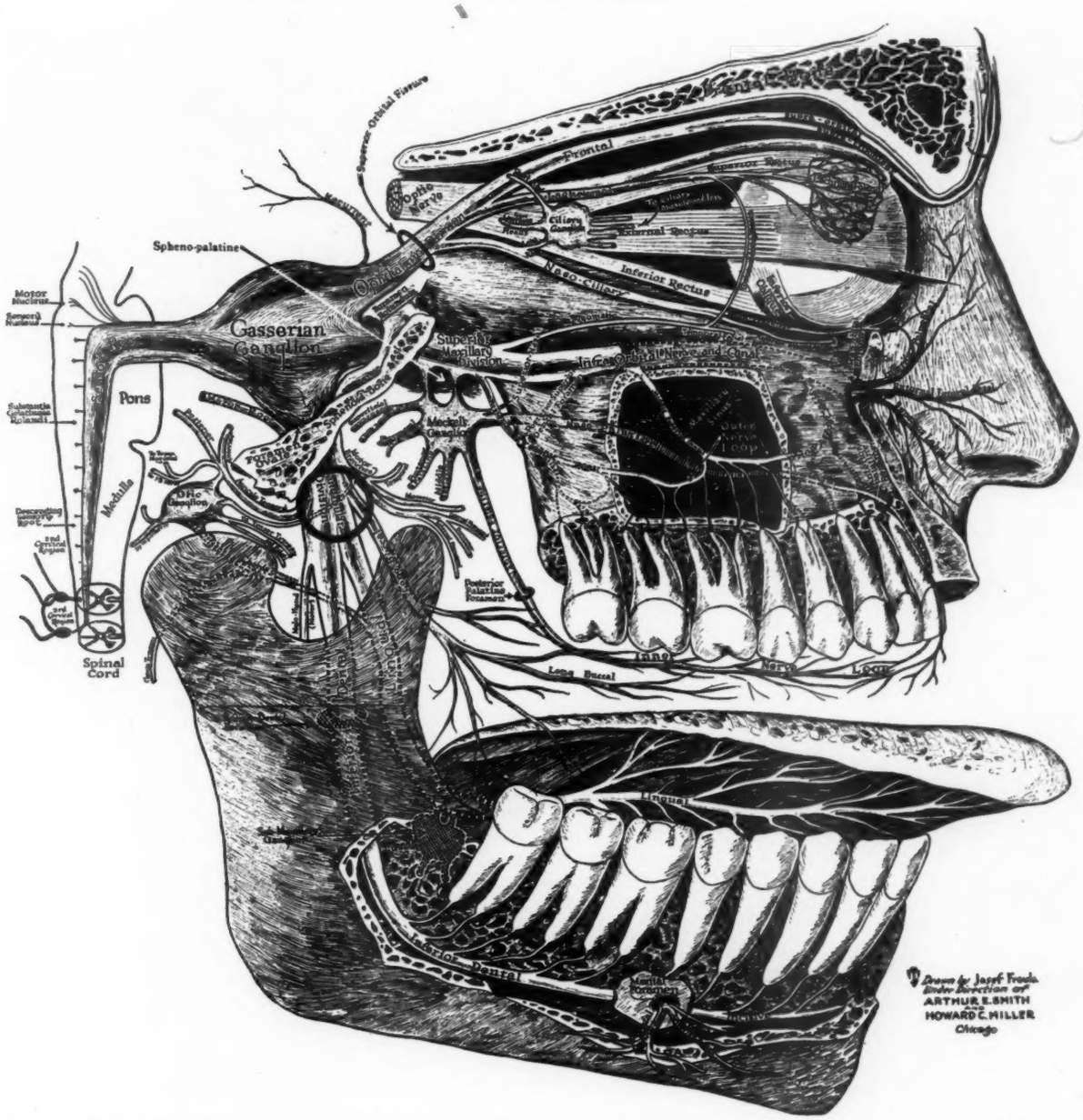

FIG. 3. Circle represents the area receiving the local anesthetic for blocking the third division of the fifth cranial nerve. (From: SMITH, A. E. Block Anesthesia and Allied Subjects. St. Louis, 1920. C. V. Mosby Co.)

Kazanjian [5] advises a 6 to 8 mm. *space filled* with a fascia lata transplant. As reported by Brophy [6], the modification suggested by Roser, which was to insert a thin gold plate after removal of the mandibular condyle, thus hoping to prevent reunion and ankylosis, was tried by Orlow. The method was employed in three cases and Orlow found that in two of these a sinus developed as a result of the irritation caused by the foreign body. Eggers [7] reported the use of interposition of tantalum foil in the creation of a new joint. Haupert [8] has used acrylic resin inserts in an attempt to prevent reformation of the bony ankylosis. Dingman [9] states, "It is unnecessary to insert any type of material into the operative defect" if there is 2 cm. of separation. Straith and Lewis [10] have recently reviewed the subject of ankylosis of the temporomandibular joint. Stuteville [11] is carrying out a most interesting project of restoring ankylosed condyles in children with potential growth centers. He is using grafts from both the fourth rib and second metatarsal bone.

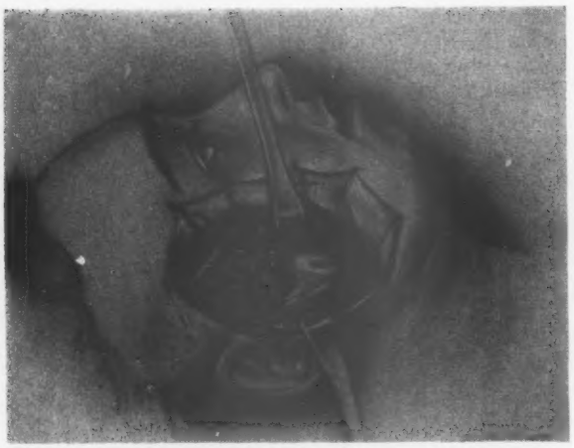

FIG. 4. Schematic drawing of reported case illustrating the deposition of bone and fibrous tissue in coronoid process and temporomandibular joint regions.

FIG. 5. Drawing at surgery showing ankylosis released. The upper portion of the coronoid process has been separated from the zygomatic arch. A curved slot 3/32 inch has divided the condyle and ascending ramus.

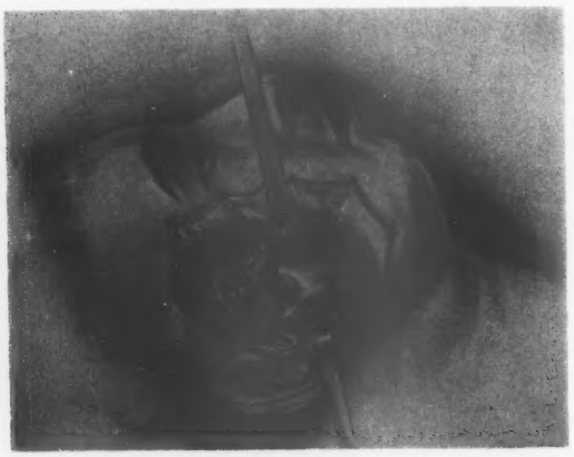

FIG. 6. Artist's drawing showing creation of new joint by means of hand-made non-electrolytic curved metal onlay secured by special screw to ramus. Note the tip of the coronoid process has been excised. Note onlay fills the curved slot in Figure 5. A movable hinge has been created. Lateral deviation of the mandible has been prevented. Original centric occlusion has been preserved.

NEW TECHNIC FOR CORRECTION OF ANKYLOSIS

Preparation of Non-electrolytic Metal Onlays. As the function of the external pterygoid muscle has been lost, the wax pattern for the metal onlays is constructed in such a manner that the interposed metal between the proximal and distal fragments of the osteotomy will be 3/32 inch wide (Figs. 1, 5 and 6) and will be in the arc of a circle, the center of which passes through the center of the ankylosed condylar head. A small tab for a drill hole is turned down so that the onlay can be fixed by means of a special screw to the ramus. This metal onlay and screw are constructed of a form of No. 18–8 stainless steel which is relatively non-electrolytic, non-magnetic, non-corrosive and produces negligible tissue reaction.*

Surgery. It can be the operator's choice whether to perform this surgery through a Risdon or a preauricular approach. We prefer the preauricular approach as it gives more direct access to the division of bone and placement of the screw to hold the metal onlay. Deep block anesthesia is employed. (Figs. 2 and 3.) In this surgery one must be prepared to ligate the external carotid artery, as in some cases of ankylosis the bone on the medial surface may surround a large vessel which may be difficult to control. We do not routinely ligate the external carotid preoperatively. After shaving the hair 2 cm. above and anterior to the ear an incision is outlined with a skin stain or dermatographic pencil along the anterior inner margin of the ear from the lobule upward and anteriorly 1 cm. above the hairline to the extent of 5 cm. The skin flap is elevated by sharp dissection, turned forward and immobilized to the cheek with two silk sutures. The mandibular notch is located by deep palpation. The superficial tissues are carefully divided down to and through the periosteum at the lowest portion of the mandibular notch. *In this area cutting is never done.* With retractors the 2 cm. opening is retracted posteriorly over the base of the neck of the condyle. (Fig. 4.) A slot 3/32 inch wide is created to conform to the previously

* Procurable from Los Angeles Dental Supply Co., Los Angeles, Calif.

FIG. 7. Preoperative photograph of patient showing micrognathia due to ankylosis, and acquired deformity of nose.

FIG. 8. Preoperative photograph showing patient's inability to open her mouth due to ankylosis of temporomandibular joint and coronoid process to zygomatic arch. Note depressor group of muscles in strained contraction typical of this deformity.

FIG. 9. Preoperative photograph illustrating micrognathia. Note scar beneath right mandible from previous surgery.

FIG. 10. Preoperative photograph showing the limit of mouth opening due to ankylosis. Note depressed nose and micrognathia.

prepared onlay with a bone burr at the base of the condylar neck. (Fig. 5.) The onlay is then interposed in this curved slot and a hole is drilled in the position of the onlay tab hole on the lateral surface of the ramus using a special precision bone burr under a constant stream of normal saline solution. The onlay is then fixed to the ramus by a special precision-made, thin, hexagon-headed, self-tapping, non-electrolytic metal screw. (Figs. 1 and 6.) The deep wound

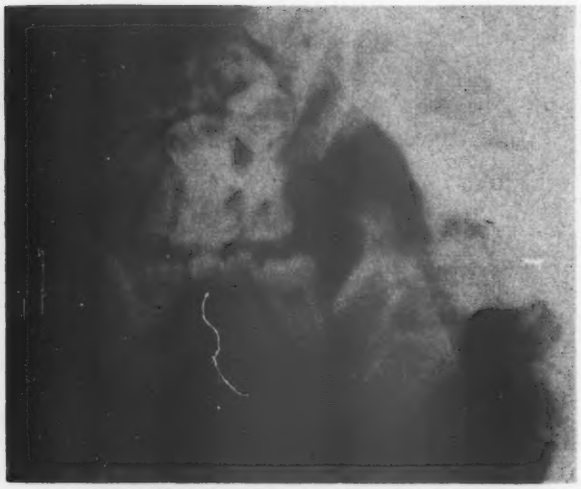

FIG. 11. Preoperative right lateral roentgenogram showing bone formation in temporomandibular joint region. Note bony attachment of coronoid process to zygomatic arch.

FIG. 12. Preoperative vertex-mental roentgenogram illustrating marked deposition of bone in the temporomandibular joint and coronoid process regions. Right side involved; left side appears normal.

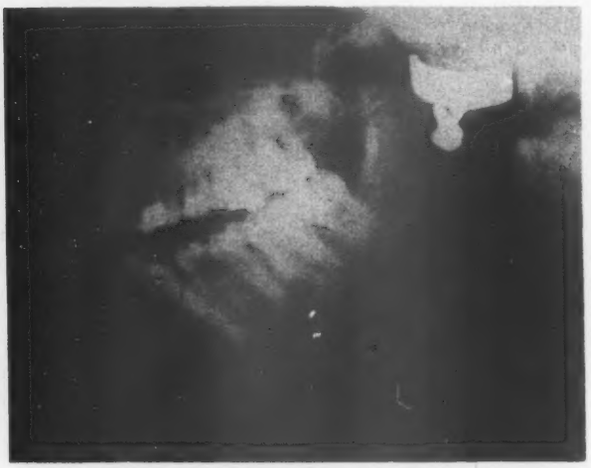

FIG. 13. Postoperative right lateral roentgenogram which illustrates a new non-magnetic onlay in place, thus creating a freely movable hinge joint.

FIG. 14. Photograph of patient with added schematic drawing to illustrate new curved metal joint in action.

is closed by approximating the separated tissues with two No. 000 chromic catgut mattress-type sutures. The cheek flap is returned to its original position and approximated with No. 000 interrupted silk in its perpendicular portion and a No. 34 stainless steel subcuticular pull-out wire in its horizontal position. A small Penrose drain is inserted beneath the skin flap ending below the ear lobule, and is removed in twenty-four to forty-eight hours. A moderate pressure dressing is applied.

ARGUMENTS

Older treatments have been directed only toward restoring the single deformity of inability to open the mouth. As this is such a crippling disease, the criterion of success has been broad. Since the mandible articulates in three places with the same bony unit, reconstructive surgery should be directed toward maximum function in all three articulations. Most older technics have had no regard for the occlusion of the teeth or disturbance in the opposite joint. If a sufficient defect is created on the affected side so that a bony bridge cannot reform, in most cases a unilateral retruded open bite type of malocclusion occurs within the dental arches. With the same type of older surgery there is also rotation of the condylar head on the normal

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FIG. 15. Postoperative photograph illustrating new joint in action. Note normal mouth opening without lateral deviation of mandible. Compare with Figure 8.

FIG. 16. Postoperative right profile view. Note mouth is wide open. Compare with Figure 10.

FIG. 17. Preoperative photograph before surgical reconstruction (for comparison with Figure 18). Note underdeveloped chin and flattened nose.

FIG. 18. Postoperative photograph. A new joint was created by means of a hand-made non-electrolytic curved metal onlay. The flattened nose was corrected by a two-section cartilage implant. The micrognathia was corrected by a nine-section cartilaginous implant. Compare with Figures 7, 8, 9 and 10 for functional and cosmetic results.

side. The slightest rotation often causes gross disturbances in the temporomandibular joint. Some textbooks on surgery report condylectomy as a treatment, and sometimes as the treatment of choice. Upon opening into an ankylosed joint, a large block of distorted bone is found. The bone between the mandibular fossa and the middle fossa of the skull is paper thin; and when one is dealing with a case of ankylosis, it is questioned whether the condyle can ever be safely removed.

CASE REPORT

M. G. (Figs. 7 to 10), a sixteen year old girl, was referred from Mexico City on December 7, 1951, for surgical reconstruction of ankylosis of

the right temporomandibular joint. The patient complained of inability to open her mouth. Her parents also complained of the appearance of her nose and chin. The condition had started when at the age of four the patient fell on her chin and nose from a 14 foot height. The parents were told that a fracture of the mandible to the right of midline had occurred. The patient was treated with a chin cup and head bandage for forty days. After the bandage was removed, the patient could open her mouth to nearly a normal opening. Gradually ankylosis occurred until by April, 1950, the patient could open her mouth less than 1 cm. In April, 1950, she was operated upon by a local surgeon in Mexico City. Following the operation the patient could open her mouth about 2 cm. by continuous use of wooden wedge exercisers. Marked weakness of the right facial muscles was also noted following this surgery. Because the wooden wedges made her teeth sore, the patient discontinued their use and the ankylosis recurred until the present admission.

Physical examination revealed a well developed, well nourished girl appearing her stated age and in no acute distress. She was able to make limited lateral and slight protrusive movements of her jaw but her opening was limited to less than 1 cm. with marked supra- and infrahyoid group muscle action. (Fig. 8.) The patient had a saddle nose with an inadequate airway. The vomer bone and lower portion of the septum was protruding into the left naris. The left nostril was occluded 90 per cent. Roentgenographic examination (Figs. 11 and 12) showed a marked bony mass in the area of the right temporomandibular joint, with a markedly lessened and roughened joint space. A diagnosis of ankylosis, almost complete, of the right temporomandibular joint was made. Associated with the injury to the jaw were the acquired nasal deformity and an underdevelopment of the right mandible with mental retrusion. On December 21, 1951, at St. Vincent's Hospital, the aforementioned procedure for the surgical correction of ankylosis was performed. At surgery it was found necessary to divide the coronoid process, as it was bridged by bone to the zygomatic arch. (Figs. 5, 6 and 14.) On March 3, 1952, a cartilage implant was placed to the symphysis area to correct the underdeveloped mandible. On March 27th a corrective rhinoplasty with cartilage graft was performed. Again, on May 2nd, additional cartilage was grafted to the mental area. The patient made uneventful recoveries from these surgeries. (Figs. 13 to 18.)

COMMENT

It is hoped that this method will prove to be another step forward in maxillofacial surgery. In the past most efforts at reconstructing temporomandibular joints have been for the treatment of ankylosis. The deformity caused by ankylosis is so great that if the only function restored by the surgeon was the ability of the patient to open his mouth, the results were considered good. Surgical advancement has been mostly directed toward the prevention of recurrence of ankylosis. Our aim in reconstructive condylar surgery should be higher. At least two factors are involved: first, to reconstruct the condyles surgically and produce freely movable joints; second, to create normal intermaxillary relation, occlusion, and establish a normal profile. The object is to give the patient a useful, movable mandible capable of masticatory function. With the loss of the external pterygoid muscle it appears today that surgical reconstruction can only restore the function of the menisco-condylar joint, i.e., the hinge action. A good hinge action of the mandible, although the masticatory efficiency is reduced, is far superior to the results of older types of surgery which created retrusion and open bite deformities. The new reconstructive surgical procedure presented herein establishes normal intermaxillary relation and occlusion. It places the stresses more physiologically on the teeth and investing tissues. Not only does it prevent the untimely loss of the patient's dentition, but also if the teeth are lost the problem of the prosthodontist is greatly facilitated. The case presented herein is one of twelve thus treated by the authors since 1947. These patients will be examined from time to time, and the functional results studied, evaluated and recorded for publication later.

SUMMARY

A new procedure for reconstruction of the temporomandibular joint in cases of ankylosis is presented. One case is presented of twelve to illustrate this problem. Older type procedures result in a unilateral, retrusive, open bite type of malocclusion, an abnormally rotated condylar head in the opposite temporomandibular joint, with a loss of masticatory function and

abnormal stress on the remaining teeth. By this new surgical procedure a normal intermaxillary relation, a normal profile and a usable masticatory organ can be re-established.

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Primary Hepatoma with Metastasis to the Mandible

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PRIMARY hepatoma is uncommon, hepatoma with metatasis is rare, but primary hepatoma with metastasis to the mandible is without precedent in the literature up to this point.

Castigliano and Rominger [1], in reviewing the literature from 1902 to 1953, found 176 instances of metastatic lesions of the jaw. They added seven of their own cases, but none primary in the liver. Mensh and Hanno [2] reported a case of hepatoma with metastases to a rib and the lung.

CASE REPORT

W. L. M., a fifty-seven year old white man, was first seen by one of us (S. G. M.) on May 7, 1956, stating that a wisdom tooth had been removed two and a half years before. Approximately two weeks after the extraction pus had formed and the area was lanced. The patient had had no difficulty for about one month, when he noticed swelling with numbness and tingling of the lip. He then consulted a dentist. Incision and drainage was done and the patient believed that pus had been evacuated. However, the swelling did not subside and another incision and drainage was done about two weeks later. Severe hemorrhage followed this procedure, which could be controlled only by suturing a pack in the wound. The following month the patient again consulted his dentist and was told that the area looked like a "blood blister." This was probed and bled excessively, requiring sutures for hemostasis.

A review of the history revealed two areas which may bear some relevancy to the present illness: (1) The patient had had an excessively heavy alcoholic intake for a period of approximately ten years following World War I. He drank about a fifth of whiskey nightly. He stated that he was not intoxicated by this and did not miss any meals, nor did he miss work. For the past twenty-five years, he had drunk eight to ten bottles of beer nightly, although in the past two years, he had cut this down to about three to four bottles. His dietary intake had been markedly deficient in fresh vegetables of any kind. He denied jaundice, light stools, dark urine and decrease in body hair or frequency of shaving. (2) In the past year there had been a sudden marked decrease in libido with some concomitant decrease in potency.

The patient stated that he had lost approximately 4 pounds in the four months preceding our examination.

He was seen by another one of us (A. D.) on May 11, 1956. Examination of the local lesion revealed an elevated spongy mass on the crest of the right mandibular alveolar ridge. It extended from the second bicuspid area to the first part of the ascending ramus. This part of the jaw was edentulous. The mass was moderately movable, relatively painless but slightly tender because of a recent incision and drainage. There were no palpable masses in the neck, submental or submaxillary areas.

A pack was in place at this examination (Fig. 1), having been placed there to control hemorrhage at the time of incision and drainage. A true evaluation therefore was not possible. However, x-ray examination indicated that this mass had invaded the mandible. (Fig. 2.)

A diagnosis had not yet been made, and consequently we arranged for an excision biopsy. Inasmuch as his home was in a distant city, the patient requested that this procedure be de-

* Present address: St. Louis, Missouri.

FIG. 1. Shows the gauze pack sutured in the wound to control bleeding.

layed about ten days to enable him to arrange his affairs.

It was suggested that he see his dentist while home to have the pack removed. This was done but recurrent hemorrhage required that another pack be sutured in place to stop the bleeding.

The patient was admitted to the hospital on May 21st. Blood was kept ready in anticipation of excessive blood loss. The following morning, under pentothal®-endotracheal anesthesia, a good-sized wedge of the mass was removed for frozen section and reported as "chronic inflammatory tissue." Accordingly an incision was made around the tumor, in clinically normal tissue, down to bone, and the mass elevated. Here an extensive cavity in the bone was palpable and visible. It was unquestionably an invasive, destructive malignant tumor. As the mass was separated from the partially destroyed lingual mandibular plate and the depth of the cavity, massive hemorrhage followed. Only hard digital pressure slowed the copious flow of an estimated loss of blood in excess of 500 cc. in several minutes. Transfusion was begun immediately and the specimen submitted for another frozen section. Several No. 3-0 black silk ligatures controlled the bleeding. The report on the mass on frozen section was "malignant tumor." The comment of the pathologist (Dr. Cajigas) was, "If I hadn't seen you remove this from the jaw I would swear it was a liver biopsy."

FIG. 2. Irregular, diffusely rarefied area beneath the bone defect. (Courtesy, Armed Forces Institute of Pathology.)

The patient was assured that this procedure was for diagnosis only and that no further surgery was to be performed at this time. All details were withheld until the paraffin section was reported three days later. (Fig. 3.)

The diagnosis of malignancy would demand a right hemimandibulectomy and radical neck

FIG. 3. Section from mandibular tumor showing cords of cells closely resembling those of the liver biopsy specimen. (Courtesy, Armed Forces Institute of Pathology.)

dissection, but the unprecedented metastasis of a hepatoma or any other metastatic tumor to the mandible would render this procedure futile. At any rate, the existence of the primary tumor site had to be established.

A frank discussion was held with the patient. The findings were made known and the existing problem explained. The plan of investigation was outlined to him and his permission was received to start as soon as possible. He was told that further local surgery at this time was of no value until the site of the cause of all his trouble could be found.

The postoperative course was uneventful. The patient was discharged from the hospital on May 24th, with instructions to return as soon as possible for further clinical and laboratory tests.

On his return the patient was seen by another of us (M. M.) on June 1st, and the findings were as follows: Physical examination, except for the mouth, showed relatively little, except for the liver which might have been 1 fingerbreadth below the costal margin but which did not cause any concern at the time. A complete x-ray study was performed which demonstrated normal long bones of the upper and lower extremities; however, some minimal calcifications in the soft tissues of both elbows were noted. There was a normally functioning gallbladder and evidence of cascading in the stomach, but the remainder of the gastrointestinal tract was found to be normal. Laboratory tests showed the following results: The stools were repeatedly negative for occult blood. Urinalyses were completely negative on two occasions, showing good function of the kidney. The blood count was 4½ million red blood cells per cu. mm., with 92 per cent or 14.4 gm. per cent of hemoglobin. The white blood cell count was 11,100 per cu. mm., with 64 per cent polymorphonuclear leukocytes, 32 per cent lymphocytes, 2 per cent eosinophils and 2 per cent band neutrophils. The blood sugar was 132 mg. per cent; cholesterol was 257 mg. per cent; van den Bergh test was 0.3 at thirty minutes and 0.6 indirect. The bromsulphalein showed 7 per cent retention. The sedimentation rate was 31. Hematocrit was 43 per cent, blood calcium 10.6 mg. per cent, acid phosphatase 0.40 Bodansky units and alkaline phosphatase 5.7 Bodansky units.

In spite of the fact that we had been given some information to incriminate the liver, we were unable to substantiate it because subsequent tests showed a cephalin flocculation of 2 plus and a normal thymol turbidity of 3½ units. Repeat examination of the chest failed to show any evidence of infiltration or disease of the ribs.

Since all accumulated clinical and laboratory findings were essentially negative, one of us (A. D.) consulted the Staff at the National Cancer Institute (W. E. S.) and urged an exploratory laparotomy on the strength of previous microscopic findings. The tests at the National Cancer Institute were repeated and the positive findings at the time of this admission are as follows: There were four sutures in the region of the alveolar ridge of the right mandible, approximately 2.5 cm. lateral to the midline. There was an area of induration beneath the suture line that measured approximately 1.5 by 1.5 cm. No separate mass could be delineated. Beneath the right mandible in the region of the submaxillary salivary gland an area of induration approximately 2.5 by 1.5 cm. could be delineated by bimanual palpation with one finger on the inside and one finger on the outside of the mouth. This area was quite firm and slightly tender. No definite discrete mass could be delineated.

Examination of the abdomen revealed the liver edge to be palpable and sharp. There was no nodularity on palpation of the surface of the liver. The liver was not enlarged but it could be readily palpated in the right and left epigastrium. The liver moved with respiration and descended approximately 1 fingerbreadth below the right costal margin on deep inspiration. The spleen and kidneys were not palpable.

Examination of the genitalia revealed the presence of a left hydrocele. Rectal examination revealed the prostate to be minimally enlarged symmetrically. Laboratory work at the time of admission showed the following: Urinalysis was completely unremarkable. Hematocrit was 52 per cent, platelets 218,000 per cu. mm., and white blood cell count 9,900 per cu. mm. with a normal differential. Serology was negative. Chemistries revealed: blood urea nitrogen 14 mg. per cent, calcium 10.4 mg. per cent, phosphorus 3.8 mg. per cent, alkaline phosphatase 2.9 Bodansky units. Total proteins were 8.1 gm. per cent, with an albumin of 3.5 gm. per cent and a globulin of 4.6 gm. per cent. Cephalin flocculation was 4 plus, thymol turbidity 5 units, acid phosphatase 0.7 Bodansky units, prothrombin time 16 seconds/14 seconds, bilirubin 0.4 mg. per cent, bromsulphalein 10 per cent in 45 minutes, chlorides 97 mEq./L., sodium 133 mEq./L., and potassium 4.2 mEq./L. Stools were negative for blood.

FIG. 4. Radiolucency of the body of the mandible due to involvement of bone. (Courtesy, Armed Forces Institute of Pathology.)

X-ray films of the skull were negative. Posteroanterior views of both mandibles showed an extensive osteolytic lesion involving the body of the right mandible and proximal portion of the ascending ramus. (Fig. 4.) The left mandible was normal. X-ray film of the cervical spine showed compression of C6 due to old trauma. X-ray film of the chest showed linear fibrosis in both lung fields, with some discrete nodules seen in the second left anterior interspace. Early metastases could not be excluded.

On several subsequent films of the chest, the last being taken on July 6, 1956, interpretation was that there was no evidence of metastatic disease. Intravenous pyelogram revealed no abnormalities. Retrograde pyelography was performed and there was a normal appearance of the entire urinary tract. Barium enema on June 6, 1956, had shown multiple diverticula of the sigmoid. Gastrointestinal series was negative for abnormal findings, as was a gallbladder series. An esophagram showed no evidence of esophageal varices. Serum electrophoresis was entirely within normal limits.

A submitted slide of the tissue taken in the original biopsy was read by our pathologist as showing metastatic carcinoma in tissue from the alveolar ridge. These sections were studied by Dr. Charles Berman of Johannesburg, Union of South Africa, who has had extensive experience with primary carcinoma of the liver. It was

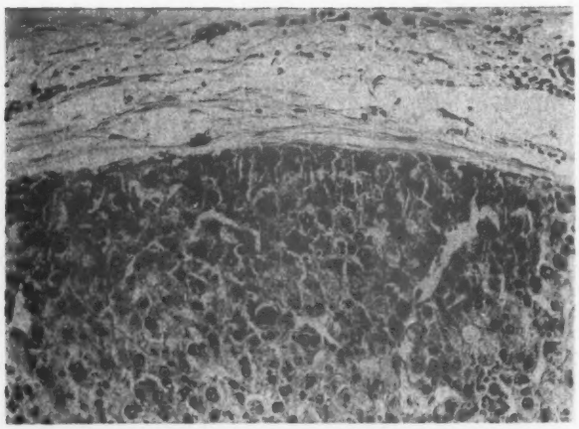

FIG. 5. Rarefied area of the mandible where the metastatic tumor invaded the bone.

his opinion that the lesion was a metastasis from hepatocellular carcinoma of the liver.

On completion of the aforementioned diagnostic procedures, exploratory laparotomy was performed on June 28th. The abdomen was entered through a right paramedian, rectus-splitting incision. The liver was found to be diffusely nodular with many hard, firm nodules as well as many hemorrhagic-appearing, bluish red blebs. Further exploration of the remainder of the abdominal contents revealed no gross pathologic disease. A characteristic section of the liver was taken from the right lobe, and this was closed by No. 2 silk mattress sutures. Another section was taken similar to the first one. The sections were reported on frozen section as showing hepatoma. The abdomen was then closed with figure-of-eight No. 2-0 wire sutures to the peritoneum and rectus, No. 2-0 braided wire sutures to the subcutaneous tissues and clips to the skin. The patient did have early postoperative atelectasis and pneumonitis but this cleared rapidly on antibiotic therapy.

Histologic study (Fig. 5) of the permanent sections of the liver showed that all the liver fragments exhibited coarse, active portal cirrhosis. There was loss of lobular architecture, division of the liver into irregular areas by fibrous trabeculae in which infiltrates of lymphocytes and plasma cells were seen, and apparent condensation of small bile ducts. No bile stasis was seen. The parenchymal cells were of two general types: (1) some cells with normal nuclei showed extensive cytoplasmic vacuolation; (2) other cells with eosinophilic cytoplasms are enlarged and have one to three hyperchromatic nuclei. In all sections, areas of hepatoma were seen. In some sections the hepatoma cells appeared to occupy a large vein. Here, these cells had the appearance of small parenchymal cells arranged as acini and pseudopapillae. In another section there were sheets of larger anaplastic parenchymal cells with eosinophilic cytoplasm, hyperchromatic nuclei, and dense, large nucleoli. The stroma consisted of sinusoids and resembled that seen in normal liver. Final pathologic diagnosis was: "multicentric hepatoma, hepatic-cell type, of the liver, portal cirrhosis and fatty change of the liver."

Following his complete recovery from the surgical procedure, the patient was transferred to the Metabolic Service for special studies. His clinical course was uncomplicated and he was discharged, feeling well, on the thirty-sixth hospital day, and returned to the care of his family physician. It was planned to readmit him when his clinical status became worse.

It is interesting to note that during the period of observation in the Cancer Institute, the patient did not complain of any pain in his mandible and, indeed, the area of induration seemed to regress and the healed biopsy wound remained unchanged in external appearance. The patient did not have any clinical signs or symptoms of cirrhosis. An esophagram was performed just before his discharge on July 10, 1956, and this revealed no evidence of esophageal varices. No ascitic fluid was present at the time of exploratory laparotomy.

The latest information, received from the patient's local physician at the end of April, 1957, indicated a rapid downhill course. Deepening jaundice and several hemorrhages have occurred, requiring external carotid ligation. At this writing the patient has been unwilling to leave home for terminal care at the National Cancer Institute.

SUMMARY

An unprecedented case of metastatic lesion of the mandible is reported, proved to be from a primary carcinoma of the liver.

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Plastic Repair for Total Loss of Mandible

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ATTEMPTS at reconstruction for total loss of the mandible by means of autogenous bone grafts have proved completely unsatisfactory, from both the æsthetic and the functional points of view. On the other hand, an intraoral prosthesis, however ineffective it may be as far as mastication is concerned, will restore facial contour fairly well and it seems to offer the only acceptable method of repair. Review of the literature shows that many ingenious prosthetic appliances have been developed for the type of facial defect under consideration. However, in most instances such mechanical devices deal with a particular problem at hand, and not with loss of the mandible as it may be encountered generally.

FIG. 1. (*a*) Loss of mandible as a result of osteomyelitis. (*b*) Elastic traction for stretching the lower lip and chin, explained in the text. (*c*) Repair of defect by means of an intraoral prosthetic device.

PREVIOUS WORK

Until recently, I have attempted to repair the deformity caused by loss of the mandible simply by constructing a prosthesis which is inserted into a surgically prepared, skin-lined pocket in the mouth. (Fig. 1.) In all such cases the tissues of the lower half of the face are badly retracted and distorted by scar tissue. An intraoral incision made behind the lower lip, chin and cheeks frees these structures, permits repositioning of them in a more nearly normal position and produces a raw cavity in the floor of the mouth. A prosthesis for holding the lower lip and chin forward cannot be introduced into this pocket until the pocket has been lined with a split-thickness skin graft. Construction of a stent (mold) to immobilize such a skin graft for a few days while it heals to the walls of the cavity poses a problem because the mandible is absent and no lower teeth or mandible is present to which the mold can be fixed. To meet such a problem I have prepared a mold in two segments, as shown in Figure 2*a*.

In the construction of the upper segment, softened dental compound contained in a metal tray is employed to obtain an impression of the upper dental arch and palate. When the com-

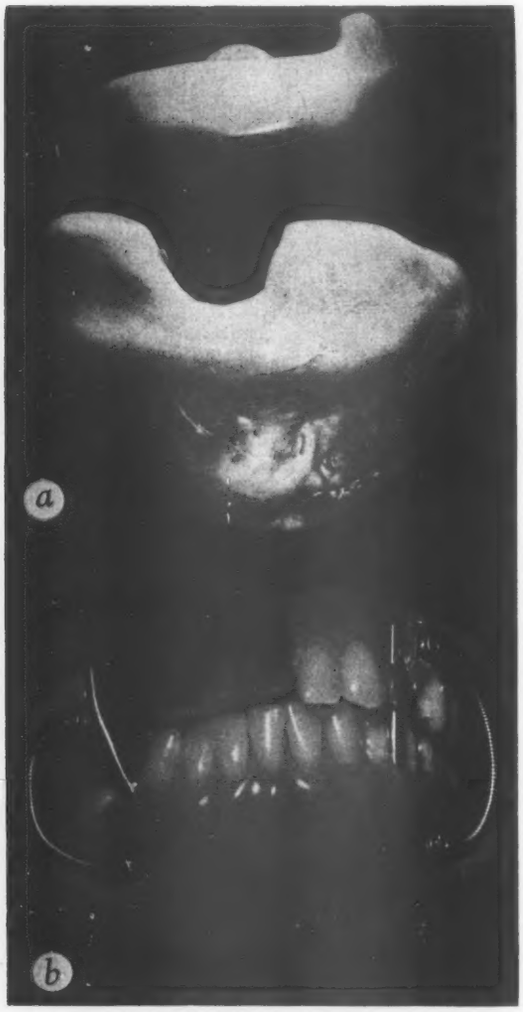

FIG. 2. (*a*) Mold (stent) made in two segments for immobilizing a skin graft in the mouth in total loss of the mandible. The skin graft is used to line a surgically prepared pocket behind the lower lip and chin for the reception of a prosthetic device. (*b*) Prosthetic appliance used in the patient shown in Figure 1. It is inserted into a surgically prepared intraoral skin-lined pocket behind the lower lip and chin, as described in the text.

pound has cooled and hardened, it is removed from the mouth and tray, after which it is reinserted into the oral cavity to form a sort of splint over the upper teeth and palate.

In the forming of the lower segment, a large quantity of softened dental compound is introduced into the surgically prepared pocket, back of the lower lip and cheeks. With the upper segment of the mold in proper place over the upper jaw, the patient bites into the softened compound below and holds the maxilla motionless until the lower bulk of compound cools and hardens. On removal from the mouth, the lower mass of hard compound is trimmed to the desired contour with a through and through hole placed anteriorly, into which a catheter or straw can be inserted for feeding the patient.

A thin, split-thickness skin graft is wrapped around the lower compound segment which has been coated with mastisol (a solution of mastic in benzene), an ideal medium for ensuring that a skin graft will adhere to a mold. The two segments of the mold are now introduced into the mouth of the patient. The lower segment is immobilized against the upper segment and against the lower lip and cheeks by means of adhesive tape passed under the chin and up over the head.

The two-piece stent is left undisturbed in the mouth for seven to ten days, at the end of which time the skin graft should be healed to the walls of the artificially created pocket. Subsequently, the compound mold is changed into an acrylic material and is worn until a prosthetic appliance can be prepared.

In most of these cases I have had a dentist construct a prosthetic appliance, as illustrated in Figure 2*b*. Metal springs from the prosthesis to a partial or full upper denture are necessary to hold the prosthetic device down when the patient attempts to open his mouth. In addition, a vertical bar on each side of the prosthetic device maintains the lower appliance in correct alignment with the upper denture. These bars slide through metal rings in the upper denture.

Sometimes after such a prosthetic device has been introduced into the mouth the lower lip is stretched and tense, often to such a degree that the patient is unable to bring the lips into apposition. If such is the case, elastic bands stretched between adhesive tape over the chin and lower lip below and adhesive tape over the head above will overcome the tendency of the lower lip to become shortened and retracted. (Fig. 1*b*.) Although this form of elastic traction to the lower lip need be used only for a few days, several months may be required for the muscles of the lower lip to develop sufficiently to impart to the lower lip a completely normal contour.

Even though this type of prosthetic appliance is very beneficial as far as restoration of normal facial contour is concerned, it is very unsatisfactory from a functional standpoint. Patients whose mandible is absent for whom I have prepared such a device usually find it necessary to remove it at mealtime because they are unable

FIG. 3. Loss of mandible as a consequence of surgical removal of an adamantinoma. (*a*) Side view; (*b*) front view.

FIG. 4. Postoperative view of the patient shown in Figure 3. The defect has been corrected by the combined use of an intraoral prosthetic appliance and a clavicular tube flap inserted in the floor of the mouth and submental region. (*a*) Front view; (*b*) side view.

to manipulate it properly during the process of swallowing.

CURRENT WORK

In the last two or three years I have effected a more desirable æsthetic and functional restoration for total loss of the mandible by the combined use of a tubed flap of skin and an intraoral prosthetic device. (Figs. 3 and 4.) This technic involves the preparation of a clavicular tube flap of skin which is elevated and eventually inlaid in a horizontal direction between the chin and the floor of the mouth. The purpose of this transference of soft tissue (skin and fat) is to eliminate the pull of scar tissue from the lower lip; otherwise the lip often is so tight over an intraoral prosthetic device that it has a tendency to force the appliance out of the mouth.

When a patient has a retracted lower lip and chin caused by loss of the mandible, a ridge of scar tissue is always found between the floor of the mouth and the lower lip and cheeks. (Fig. 5*a*.) In the newer technic of use of a tubed

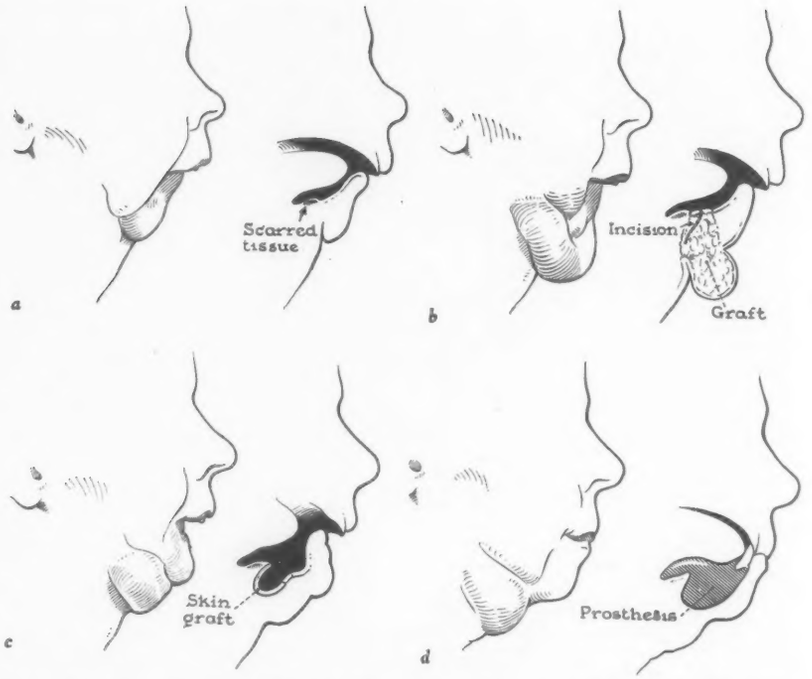

FIG. 5. (*a*) Profile and sagittal section of the face of the patient shown in Figures 3 and 4. This drawing shows a small, scarred ridge between the floor of the mouth and the lower lip; this ridge was converted into a sort of alveolar ridge for retention of a prosthetic appliance. (*b*) A clavicular tube flap has been wedged in between the lower lip and chin and floor of the mouth. All the fat in the tube was left intact. The dotted line indicates the area in which an incision was made subsequently, just anterior to the scarred ridge mentioned in Figure 5*a*. (*c*) When the edges of the incision mentioned in Figure 5*b* were separated, a rather large pocket was produced thereby for the reception of a prosthetic appliance. This pocket was lined with a split-thickness skin graft. (*d*) Prosthetic appliance in position in the skin-lined pocket; this prosthetic device fits over the ridge-like structure in the floor of the mouth, an arrangement which prevents the appliance from being dislodged.

flap of skin and a prosthetic device I have attempted to transform this ridge of scar tissue into a sort of alveolar ridge over which the prosthesis is ultimately placed; in so doing, I have found that the prosthetic device is much more stable in the mouth, requires no attachments to the upper denture and can be used to masticate soft foods.

In preparation of the tubed skin graft, a double pedicle flap of skin is elevated and tubed in an oblique direction across one clavicle. One month later the supraclavicular end of the tube is detached and transferred to one or the other of the submaxillary regions. Three weeks later the infraclavicular end of the tube is cut off and transplanted to the opposite submaxillary region. (Fig. 6.) With the passing of another three weeks, a horizontal incision is made from the submental region into the oral cavity; this cut, which completely frees all attachments of the chin and lower lip from the floor of the mouth, is situated just anterior to the scarred ridge previously mentioned. The tube flap then can be wedged into this incision to force the lower lip and chin forward. (Fig. 4*b*.) Horizontal incisions along the anterior and posterior surfaces of the tube divide it into an upper intraoral portion and a lower external part. The edges of the skin of the upper half of the tube are sutured to the oral mucous membrane, while the edges of the lower part of the tube are stitched to the adjacent skin margins. By this arrangement the skin on the upper surface of the tube flap forms the epithelial lining of the mouth between the lower lip and floor of the mouth; the skin on the undersurface of the tube becomes a part of the external skin covering of the submental region. No fat in the tube is disturbed or removed, so that a bulk of soft tissue remains behind the chin to hold it forward and prevent subsequent contractures.

After the tubed flap is completely healed in its new position, the next step in the reconstructive process involves the creation of a lower

FIG. 6.

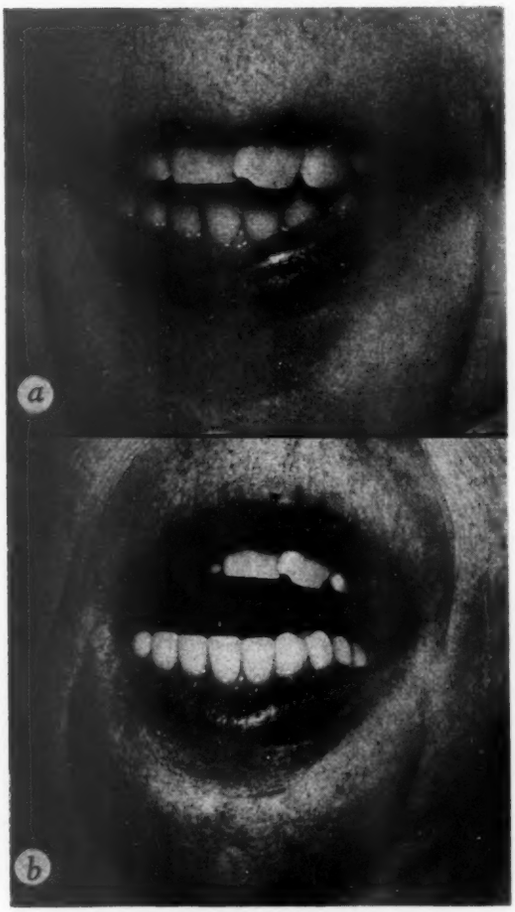

FIG. 7.

FIG. 8.

FIG. 6. Same patient as shown in Figures 3 and 4. The clavicular tube of skin is attached to either side of the chin. Later this flap was opened up and wedged in an incision between the lower lip and chin and the floor of the mouth. This flap of skin is helpful in holding the lower lip and chin forward.

FIG. 7. (*a*) Same patient as shown in Figures 3 to 6. Prosthetic device in place with the mouth closed. By using the muscles of expression about the mouth, the patient can bring the teeth on the prosthetic device into normal occlusion with the upper teeth. (*b*) The patient's mouth is open. The prosthetic appliance fits well enough in the mouth so that the patient can use it to masticate soft foods, as explained in the text.

FIG. 8. Loss of mandible as a result of radiation necrosis. A clavicular tube flap of skin was elevated and later used in a manner similar to that described for the patient in Figures 3 and 4.

alveolar ridge, which helps to prevent the intraoral prosthetic device from slipping around in the mouth and which gives the appliance some degree of stability. The preparation of such a ridge is accomplished by an incision through the intraoral part of the tubed flap, just anterior to the scarred ridge which has been previously described. This incision is carried down into the underlying fat of the tube and backward under the scarred ridge. (Fig. *5b.*) When this incision is spread, a rather large pocket is produced for reception of the proposed prosthetic device. To prevent obliteration of the pocket by scar tissue, it is imperative that the cavity be lined with a skin graft. (Fig. *5c.*)

As mentioned previously, effective skin grafting in such a pocket requires the use of a dental compound stent or mold, around which a thin, split-thickness graft is wrapped. In the intraoral pocket described herein the skin-covered stent is immobilized merely by means of heavy cotton sutures. Ten days later the stent is removed and the skin-lined pocket is ready for the reception of a prosthetic appliance. (Fig. *5d.*)

An acrylic prosthetic device with lower artificial teeth to occlude with the patient's upper teeth or denture is prepared by a dentist; this appliance is made to fit over the scarred ridge in the floor of the mouth into the skin-lined pocket. (Fig. *5d.*)

COMMENT

I have employed the foregoing technic of the use of a clavicular tube flap and intraoral prosthetic device in two cases. For one patient the work has been finished for two years; in the other the work is nearing completion. In the former case I found that the prosthetic appliance could be seated very securely over the scarred ridge. In fact, it fits almost as well as does the average lower denture. The tubed flap of skin eliminates excessive scarring behind the lower lip and chin, and has left the lower lip freely movable, with no tendency to displace the dental appliance. By use of the muscles of expression about the mouth, the patient has learned to masticate soft foods. (Fig. 7.) Furthermore, her facial appearance and her speech are almost normal. (Fig. 4.) In the second case, although the reconstruction is not finished, the results thus far seem to be equally good. (Fig. 8.) Although this technic still leaves much to be desired, it has effected more satisfactory results than any other technic which I have attempted to employ.

Radical Surgery for Intraoral Cancer with Preservation of the Mandible

THE EN BLOC PULL-THROUGH PROCEDURE

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WITH our present knowledge of cancer, we cannot change this fundamental surgical concept, namely, that malignant disease can be eradicated only under adequate exposure to include a wide excision of the primary site in continuity with at least the regional lymphatic drainage. In surgery for cancer of the mouth, therefore, it is requisite at times to resect a portion of the mandible for the sole purpose of obtaining adequate exposure, because the mandible presents a bony obstruction to exposure and wide excision in continuity. No such problem is encountered in the more common radical mastectomy, for example, with full access to the axilla.

However, malignant disease of the oral cavity differs from other sites of origin in several respects: (1) In most cases the cancer maintains itself locally, and its spread is extended only to the regional metastases in the neck. Martin [*4,5,8*] reported distant metastases in only twelve of *556* cases of cancer of the tongue, 1 per cent of 103 cases of cancer of the floor of the mouth, 2 per cent of ninety-nine cases of cancer of the buccal mucosa, and *5* per cent of 113 cases of cancer of the gingiva. Duval and Healy [*13*] state that in a study of 112 cases of lingual cancer the tendency to metastasize is the most important single factor in determining the outcome of cancer of the tongue. These authors add that cancers of the tongue as well as other cancers of the head and neck remain confined to the regional cervical lymph nodes in almost 90 per cent of all cases. Even in the end stages of this disease the malignant process remains regional. The patient dies not directly from the cancer but as a result of toxicity and cachexia. Perhaps a tracheostomy or gastrostomy will have been performed for dubious symptomatic relief. In spite of the histologically malignant tissue, one might suggest that cancer of the mouth is a locally malignant disease, although this term is usually reserved for benign tumors that by direct extension are destructive, such as the ameloblastoma. Intraoral cancer is somewhat comparable to cancer of the cervix which extends locally in the pelvis until the progressive obstruction to the renal output causes death. (2) Cancer of the mouth also follows a rather consistent pathogenesis to those who have a broad clinical experience. The disease will spread almost routinely to the regional lymphatics on the same side of the neck, rarely to the contralateral neck nodes. However when the primary lesion has not been completely removed, there still must be metastasizing cells. If the normal lymphatic pathways are not available, then the discharging cells will spread to other lymphatic outlets. If these normal pathways are blocked with disease, sclerosed with radiation therapy, or surgically removed, the spread of cancer will extend to unpredicted sites. The most important factor, therefore, is complete extirpation of the primary site when the draining lymphatics are included. There is a nebulous theory expressed by some surgeons that neck dissection should be performed at an arbitrary three weeks' period after the primary site is removed. I have seen several recent cases in which this has been performed. The patients appeared particularly distressed; the primary malignant site was obviously uncontrolled and the lymphatics were bursting with disease in unpredictable areas. The radical neck dissection performed bilaterally aggravated this grotesque picture.

CLASSIFICATION

Intraoral cancer may be classified into two groups: anatomical and histological. (1) The anatomical classification has a more practical usage when we speak of cancer of the tongue, floor of the mouth, gingiva, etc. This is an extremely rough classification, however. The primary site can be truthfully identified to a specific zone only if the disease is early and localized. Furthermore, a more specific reference should be made to the tongue, for instance, when cancer of the anterior third of the tongue would give a much different pathogenesis and salvage rate than cancer at the base of the tongue. (2) The histological classification may be divided into the tissue diagnosis and the cell grade. The tissue report will indicate whether the disease is a carcinoma or a sarcoma, and the cell grade will suggest the degree of malignancy from grade 1 to 4. Grade 1 is the low grade denoting a lesser degree of invasiveness while grade 4 indicates the anaplastic, highly malignant type. The distinction between the grades is not too well defined and one must remember that grading will differ throughout a biopsy specimen to varying degrees. Therefore, grading of a small biopsy specimen must be rechecked against the gross specimen later. A combined report of the anatomical and histological classification will afford the best information for evaluating the treatment, pathogenesis, and prognosis when cancer of the mouth is to be considered. In addition, the presence or absence of nodes in the dissected specimen will give the most complete answer, e.g., squamous carcinoma of the tongue, grade 1, with no positive nodes, or epidermoid carcinoma of the floor of the mouth, grade 2, with positive neck nodes.

The wide majority of such reports indicates that most oral lesions are not radiosensitive and therefore surgery is the treatment of choice. Rauhausen and Sayago [2] report forty cases of cancer of the floor of the mouth treated with radiation. Thirty-five of these were diagnosed histologically as epidermoid carcinoma grade 1, which is radiologically insensitive. Only six patients had a five-year survival and not one of these had metastases to the lymph nodes or invasion of the gum. Paymaster [12] reports 650 cases of cancer of the buccal mucosa and states that histologically the neoplasms were mostly squamous or epidermoid cancers, grade 2. Modlin and Johnson [8] confirmed the above with a report of malignant lesions of the lower gingiva and buccal mucosa which were mostly grade 1 and 2 histologically.

COMMENTS

The mounting evidence of confirmatory reports regarding intraoral cancer gives strong support to the choice of surgery as the indicated therapy, and since most patients present themselves with a moderately advanced tumor, the surgical approach must be radical. Eradication of the disease with a wide dissection must be the primary concern of the surgeon, and anyone who speaks of facial deformity as a result of radical surgery should be reminded forcibly that the worst cosmetic result is recurrent cancer. This *en bloc* resection has been established predominently by Dr. Hayes Martin of Memorial Hospital in New York City, and continued by those whose experiences are sufficient to enable them to see the ravages of uncontrolled cancer. The results and rate of cure are not high enough to make us proud, and must be improved. Nevertheless, at the present, it is the only method which offers the best results.

In spite of the impressive demand to maintain the accepted surgical approach, there are indications for a modification of this type of *en bloc* resection. The population is being educated to seek medical examination, and there are increasing reports that doctors are seeing cancer earlier in onset and smaller in size. Calvin Klopp informed me at the last meeting of the James Ewing Society that he was impressed by the increasing number of early lesions of the floor of the mouth that were noted recently. Frank E. Adair states that he scarcely sees the large bulky tumors of the breast which were relatively common only a few years ago. The dental profession has taken an extremely active responsibility towards the detection of intraoral cancer and deserves most of the credit for referring early suspicious lesions. Under these circumstances, therefore, surgery can be just as inclusive and yet preserve an important function of the jaw, providing the tumor is small and localized. There is an old Italian saying, "Chi cambia metodo peso porta." Who changes the method must carry the burden; in this case, the responsibility for the patient's existence. Therefore, modification of the accepted surgical technic can be sug-

gested to preserve the function of the mandible yet maintain the requisite wide excision of the malignant process under certain rigid conditions.

THE MANDIBLE

To understand these conditions, it is necessary to realize the following facts: the mandible is the obstructing bone in this surgical procedure, yet the discussion of its importance should center on the confusion that has been created between the cosmetic and functional results. No one has written specifically about either. The fact is that once the continuity of the mandible has been interrupted by a resection of bone, that person can never again chew a good steak. And this function of a strong bite is lost notwithstanding any graft or prosthetic plastic or metal replacement, even in the few cases in which this gap has been successfully bridged.

The cosmetic result varies with the extent and area of resected bone. The most noticeable facial asymmetry can be observed in those who have had a resection to include a disarticulation at the temporomandibular joint where the side of the face is flattened considerably, or where the resection extends from one side to across the midline with a consequent deformity of the chin. Fortunately many of the cases can be treated by resection within the zone extending from the mid-ramus to within 2.0 cm. of the midline. We have not had enough success with a primary graft to consider this additional surgery at the time of the initial operation; and this includes the use of metal, polyethylene plate, and polyvinyl sponge as well as bone. Apparently, radical surgery with its wide removal of tissue leaves an insufficient amount of surrounding connective tissue and epithelium to support a primary graft. A secondary graft of bone, on the other hand, done extraorally is a much more satisfactory procedure for us. For our private patients, a graft is recommended to be performed after a year has elapsed; but when the patient is made to understand that it will be done to improve the facial asymmetry but not the function of the jaw, not one to date, in our experience, has consented to have this additional surgery. Nor have we had the success claimed by some of obtaining exposure by incising the mandible and retracting the cut edges.

Because of these facts, therefore, in carefully selected cases, we propose to modify the present radical surgery to maintain the *en bloc* resection and yet retain the mandible so as to preserve the normal functioning of the jaw.

CRITERIA

Unfortunately there is no clear-cut course of action indicated in modifying the accepted surgical procedure; furthermore, the stakes are high and while the surgeon must admit that the results are regrettable, the patient pays the full price of total failure. Therefore rigid conditions must be established for a modified radical procedure in the control of this disease. The area of excision of the primary site must be relatively just as wide in relation to the size of the lesion, and exposure must be just as adequate to dissect the lymphatics in continuity. Under the following conditions, then, a neoplasm can be selected for eradication by a pull-through procedure: (1) Cancer must be early in onset and supported by the history which must be recent. There must be no history of previous treatment, otherwise the clear outline of the tumor cannot be seen. (2) The tumor must be visible, for only then can one identify its true outline. This of course will limit most of these cases to the anterior oral cavity, and perhaps rightly so since lesions in the posterior pharyngeal region cannot be identified as clearly. (3) The neoplasm should not be over 1.0 cm. in size both by gross inspection and palpation; this will add confirmatory proof that the lesion is small and early in onset. (4) There must be no attachment to the adjacent bone. To be certain of this, at least 1.0 cm. of normal tissue must separate bone from the adjacent border of the mass. Every rule has its exception, and recently we have added the exceptional case of an early cancer of the gingiva, which is freely moveable over the adjacent bone, requiring a segmental portion of the bone to be included and dissected through into the neck tissues. (5) This procedure cannot be done efficiently in those patients with a large thick mandible, especially if it is accompanied by a full set of teeth which would make intraoral surgery difficult and relatively inaccessible.

Most cancers acceptable for the pull-through will probably be located in the anterior two-thirds of the tongue and floor of the mouth. Another involved region that might be considered for this procedure is malignant ulcera-

tion of the buccal mucosa, in which the affected tissue is pulled through superficial to the bone.

RADICAL EN BLOC PULL-THROUGH

The *en bloc* pull-through procedure, therefore, may be tentatively classified as follows: (1) deep pull-through, in which the neck dissection is done in continuity with a neoplasm deep or medial to the mandible; (2) segmental mandibular pull-through, in which the segmentally resected portion of bone is added to the tissue delivered into the neck dissection; (3) superficial pull-through, in which the widely dissected lesion is brought into the neck dissection superficial or lateral to the mandible.

In all cases the periosteum must be excised with the specimen since it acts as the last barrier to direct extension into the bone, and according to Polya [*14*], may contain lymphatic channels. He found that in 50 per cent of normal subjects the lymphatics of the tongue and floor of the mouth pass through the periosteum in their descent to the neck. Since there is a decussation of lymphatics in the oral cavity, if the neoplasm is close to the midline, at least a contralateral upper neck dissection should be performed. Without palpable nodes an upper neck dissection is suggested. However, if there is suspicion of a neck node, a complete or radical neck dissection is indicated. Klopp [*1*] has reported his experiences with this procedure, although he limits this surgery to lesions in the anterior floor of the mouth. He performs a bilateral upper neck dissection in continuity, but suggests a radical neck dissection when palpable nodes are present. In a number of Klopp's cases a segmental inner cortex of bone is included in the dissected specimen. Of twelve patients treated by him with bilateral upper neck dissection in continuity with the primary disease, four died of recurrent cancer, of whom two had positive neck nodes, and eight are living and well, one to three years postoperatively. Slaughter [*17*] is another of the few authors on this subject, but he includes disease at the base of the tongue. Our experience has been that most of the cancers at this anatomical site are usually detected at a later date, and the indication for wide exposure dictates a resection of a portion of the mandible. Berridge and James [*11*] bear me out in their series of 102 cases of lingual cancer by stating "when cancer of the base or posterior third of the tongue are found they are usually large, and palpable lymph nodes are present on admission in 54%."

Several workers have described a reverse pull-through. Ward and Robben [*15*] describe such a pull-through by Mark Ravitch in which he excised a large neurofibroma from the base of the tongue by pulling the submaxillary contents into the mouth. Ward and Hendrick [*16*] used this procedure at first, but now accept the pull-through into the neck as the preferred surgery. This technic is not new with our generation since Martin in his "History of Lingual Cancer" [*9*] shows a picture from Erichsen's book written in 1884 of a pull-through as an exposure technic for glossectomy.

SURGICAL TECHNIC

Let us now consider a detailed surgical report of the radical en-bloc pull-through procedure on the basis of our experience. Assume the patient has an early neoplasm on the lateral border of the middle third of the tongue with a palpable neck node. (Fig. 1.)

The patient is first prepared and draped with the head and neck in a hyperextended position. Routine radical neck dissection is performed to include the internal jugular vein and the sternomastoid muscle. (Fig. 2.) The dissection is carried to above the bifurcation of the common carotid artery, and the internal jugular vein is ligated and cut high in the neck close to the jugular foramen. The upper triangular skin flap with its attached platysma muscle has previously been dissected just over the lower border of the mandible. The periosteum of the lower border of the mandible is incised and stripped with a periosteal elevator for a short distance upward along the inner or lingual surface of the mandible. This leaves the neck dissection free with a broad pedicle at the upper neck and in continuity with the intraoral disease. (Fig. 3.) A sterile laparotomy pad is then placed over the neck dissection and the head is turned to the midline position in order to initiate the intraoral phase.

The pharynx is packed snugly with 2 inch gauze around the intratracheal tube to avoid pulmonary aspiration. An incision is then made in the mucosa of the adjacent gingiva for a varying distance which will permit a separation of the deep periosteum to connect with the freed portion below. This portion of the periosteum should be long enough to allow easy mobility

FIG. 1. Case A. N. Ulcerating squamous carcinoma of the tongue.

FIG. 2. Case A. N. Pull-through procedure including a radical neck dissection.

of the lateral tongue and floor of the mouth. By moderate pressure on the tongue these lateral contents may be depressed into the upper neck below the mandible. Further traction may be obtained by inserting heavy silk sutures anteriorly and posteriorly into the tissue of the tongue. With the pull-through effected sufficiently to give adequate exposure, an incision is carried well around the intraoral disease, and the remainder of the connective tissue holding the dissection in the digastric triangle is liberated to complete the surgery in continuity. The surgical specimen should include the intraoral disease with the adjacent periosteum in continuity with the radical neck dissection. Occasionally a more liberal freeing of the digastric triangle may be carried out although this may result in a disruption and separation of the neck dissection from the intraoral contents.

Closure must be done carefully to avoid an oral cutaneous fistula which creates a prolonged morbidity and feeding problem. Since there is strong traction on the tongue when the patient swallows or attempts to speak, the suture line may break down with the resulting oral secretions draining into the neck. In addition to the routine closure of interrupted sutures to approximate the lateral tongue to the gingival mucosa, an additional layer of heavy interrupted retention sutures is placed deeper into the tongue and around the mandible or between any existing teeth. The neck dissection is closed routinely; however in addition to the lower Penrose drain, another drain is brought out through the upper triangle of the skin incision to control a possible fistula from draining into the lower neck. An upper-draining fistula usually will close spontaneously with less prolonged difficulties.

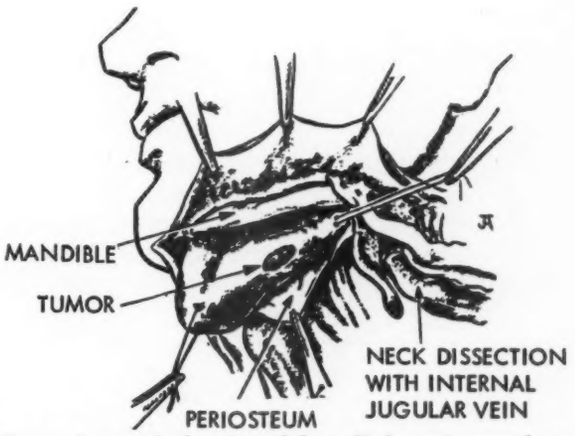

FIG. 3. Anatomic drawing of the pull-through procedure. The neck dissection has been stripped laterally to expose the tongue below the mandible.

A tracheostomy is strongly advised as a final step, and this tube can be removed in forty-eight hours. Nasal tube feedings must be maintained for at least seven days postoperatively.

The case abstracts in Table 1 concern twelve patients who were operated upon from 1952 to the present. The small number of cases represent various types of cancer and no conclusions will be made.

TABLE 1

Patient, Age, Sex	Disease	Nodes	Surgery in Continuity	Result
G.N., 54, M	Squamous cancer of the floor of the mouth	Positive	Bilateral radical neck dissection	NED* 6 years
B.M., 41, M	Adenocarcinoma of sublingual gland	Negative	Left upper neck dissection	NED 2 years
W. B., 35, M	Squamous cancer of the floor of the mouth	Negative	Bilateral upper neck dissection	NED 4 months
L. L., 55, M	Epidermoid cancer of the floor of the mouth	Positive	Radical neck dissection	Died 6 months
A. N., 55, F	Squamous cancer of the tongue	Positive	Radical neck dissection	Died 9 months
D. M., 75, F	Malignant mixed tumor of submaxillary gland	Negative	Upper neck dissection	NED 6 months
J. K., 70, M	Alveolar mucoid cancer of the floor of the mouth	Negative	Upper neck dissection	NED 17 months
M. C., 53, F	Lymphoblastoma of sublingual gland	Negative	Upper neck dissection	NED 5 months
F. K., 72, M	Squamous cancer of the gingiva	Positive	Upper neck with segmental bone dissection	Died 13 months
P. F., 53, M	Squamous cancer of the floor of the mouth	Negative	Radical neck and upper neck dissection	NED 5½ years
F. P., 61, F	Squamous cancer of the gingiva	Negative	Upper neck and segmental bone dissection	NED 1 year
J. K., 68, M	Squamous cancer of the floor of the month	Negative	Bilateral upper neck dissection	NED 2½ years

NOTE: NED = No evidence of disease.

The case reports are those requiring further explanatory remarks concerning complications which could not be explained in the abstracts.

CASE REPORTS

CASE 1. G. N., a fifty-four year old man, was first seen in September, 1951, with a neoplasm in the left floor of the mouth and a firm node in the upper neck. (Fig. 4.) A deep pull-through was performed in continuity with a radical neck dissection. Six months later a mass in the right neck was noted and a radical dissection of the right side was carried out. (Fig. 5.) Final diagnosis was epidermoid carcinoma, grade 2, of the left lateral floor of the mouth with bilateral positive neck nodes. The patient has been

FIG. 4. Case 1. (G. N.) Squamous carcinoma in the lateral floor of the mouth with bilateral neck nodes.

FIG. 5. Case 1. (G. N.) Bilateral neck dissection in continuity with lateral floor of the mouth. No evidence of the disease for five years.

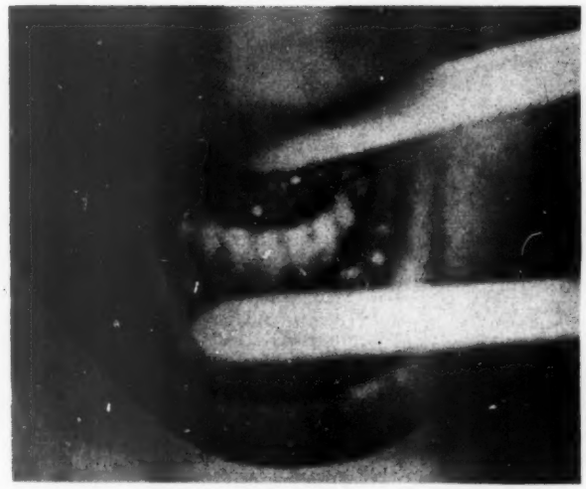

FIG. 6. Case III. (W. B.) Recurrent epidermoid carcinoma in the floor of the mouth following a bilateral pull-through in the upper part of the neck.

FIG. 7. Case III. (W. B.), postoperatively, following anterior jaw resection for recurrent carcinoma in the floor of the mouth. The heavy set jaw and full teeth make intraoral exposure difficult.

without evidence of disease since treatment, more than five years.

CASE II. When first seen in April, 1954, B. M., a forty-one year old man, stated that he had noted a lump in his mouth four months previously which several doctors had tried to aspirate, probably for biopsy purposes. He stated that two years previously he had had a tumor removed from the left lateral floor of the mouth which the doctor had called adenocarcinoma of the sublingual gland. On April 5th, 1954, a deep pull-through in continuity with an upper neck dissection was performed. The report was adenocarcinoma of the sublingual gland with no positive neck nodes. Two years later the patient was referred for a left lower lobectomy for an isolated mass in the lung. He has been well since. Final diagnosis was recurrent adenocarcinoma of the left sublingual gland with solitary metastasis in the left lung.

CASE III. W. B., a thirty-five year old man, was first seen with a small lesion in the midline of the floor of the mouth. In January, 1951, a deep pull-through to include a bilateral upper neck dissection was performed. (Fig. 6.) Six weeks later a small recurrence was noted and surgery was again performed to include a wide resection of the primary site and a portion of the anterior mandible. (Fig. 7.) Final diagnosis was epidermoid carcinoma, grade 2, of the anterior floor of the mouth with negative neck nodes.

CASE IV. In July, 1953, L. L., a fifty-five year old man, underwent radical resection of the right side of the neck and the jaw for an ulcerating carcinoma of the right side of the base of the tongue with a positive neck node. He was well until February, 1956, when a small lesion was widely excised from the left lateral floor of the mouth. A recurrence of this lesion was noted in April, 1956, and an *en bloc* pull-through including an upper neck dissection on the left side was carried out. Another mass in the left supraclavicular region was widely removed in March, 1957, following which a rapidly progressive inoperable status developed. The final diagnosis was epidermoid carcinoma, grade 2, of the base of the tongue with metastases to the contralateral neck.

CASE V. P. F., a fifty-three year old man, underwent a pull-through procedure to include a radical dissection of the right side of the neck and a contralateral upper neck dissection for a neoplasm of the floor of the mouth just to the right of the midline with a negative node report. He was well until August, 1955, when a neoplasm of the gingiva to the left of the midline developed, for which a partial mandibulectomy was performed. Ever since this surgery, the patient has remained without evidence of disease. The final diagnosis was epidermoid carcinoma, grade 1, of the floor of the mouth with negative neck nodes and a multiple primary epidermoidc arcinoma of the gingiva, grade 2.

SUMMARY

The patient with intraoral cancer is offered the best chance of survival when the accepted surgical procedure of an *en bloc* radical resection of the neck and the jaw is performed in continuity with the regional lymphatics.

A modification of this surgery is indicated only in a select few when the malignant lesion is clearly defined upon examination, and evaluated as early, small, and at least 1.0 cm. free from adjacent bone.

The modified procedure, the radical *en bloc* pull-through, preserves the mandible and its function, yet, widely exposes the neoplasm to radical extirpation to include the neck dissection in continuity.

"Chi cambia metodo peso porta." The surgeon who changes the method must carry the burden of responsibility for the future of his patient.

Anyone concerned with facial deformity as a result of radical surgery must be reminded that the worst cosmetic result is due to recurrent cancer.

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The Surgical Treatment of Malignant Tumors of the Maxillofacial Area

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BEFORE we can discuss the surgical treatment of tumors of the maxillofacial area, we must understand what we mean when we say the maxillofacial area. This is the area of the face, jaw and neck. It is the area above the clavicle, excluding the eye, the central nervous system and the middle and inner ear.

In the surgical treatment of tumors of this area the first group of tumors to be considered is that of the skin, or the covering of the maxillofacial area. Those tumors involving the skin which are treated surgically are basal cell carcinoma, squamous cell carcinoma and melanoma. There are many ways of treating basal cell carcinoma, and the method of choice varies according to the case. There is only one objective in treating a basal cell carcinoma, and this is the same for all tumors: It is to separate the patient from his disease. Ideally, we would also like to return the surrounding tissues to their normal appearance and leave no residual effect of the tumor. Since we must make a diagnosis and this diagnosis can be substantiated only by histopathological studies, it is necessary to remove some of the tissue surgically in order to study it microscopically. For this reason, in early or small tumors the treatment is carried out before the diagnosis is made. This is done by excising widely enough to make sure all the tumor has been removed. The defect is then closed and the specimen is submitted to the pathologist, who establishes the diagnosis.

In the case of large tumors it may be difficult to remove the entire tumor without performing some reconstructive procedure. In these cases it may be better merely to make the diagnosis and then treat the patient with some other method, such as radiation. However since we are discussing the surgical care of tumors, we will merely state that there are some cases in which other treatment is preferable. Many times we can excise a good-sized tumor of the skin of the face or neck and repair the defect by a rotational flap. (Figs. 1 and 2.) Occasionally it is necessary to cover the defect with tissue transported from other parts of the body. (Fig. 3.)

The basal cell carcinoma of the skin of the face and neck does not metastasize. Therefore the draining lymphatics are not involved and block dissection is not necessary. Squamous cell carcinoma of the skin of the face and neck is not as common as basal cell carcinoma; however, it is not a rare disease. Since these tumors are visible, the patient usually seeks treatment early when metastases are not common. Probably the most common site of squamous cell carcinoma of the skin is the area of the lower lip. These tumors are treated by wide excision and plastic closure. The drainage nodes are removed when involved. (Fig. 4.)

Fortunately, the melanoma of the maxillofacial area is not as common as basal cell or squamous cell carcinoma. These tumors should be excised widely, and at a later date the draining lymph channels and nodes should be removed by block dissection. The reason for this is the high percentage of these tumors which metastasize to the regional lymph nodes. Block dissection is advisable to increase the percentage of survival.

The malignant tumors of the mucous membrane are usually squamous cell carcinomas. Again the ideal treatment for these tumors is to separate the patient from his disease. Since most of these areas are visible to the patient we usually see these tumors early. Yet the five-year survival rate is not as high as it should be,

FIG. 1. This patient had basal cell carcinoma of the nose which was treated by wide excision. The defect was repaired by a rotational flap.

FIG. 2. The rotational flap can be seen in position.

FIG. 3. This patient was treated by radiation for hemangioma in infancy. Later basal squamous cell carcinoma developed in the radiation burn area in the labial fold of the nose. The area was excised and covered by an abdominal tube transported on the wrist, as illustrated.

FIG. 4. This patient suffered a multicentric squamous cell carcinoma of the lower lip treated by V-excision and lip shave.

mainly because tumors are not treated early enough and vigorously enough to insure a complete removal. The second reason that the survival rate is not higher is that the tumors are multicentric, and the patient who has one tumor will probably get another in some adjoining tissue in a relatively short time. (Fig. 4.) Before we can confirm our clinical diagnosis, we must submit tissue for histopathological study. Therefore the small tumors are excised completely and sent to the pathologist for diagnosis. If the tumor has been separated completely, we have cured the patient of this particular tumor. If the tumor is large and our clinical impression is that it is a squamous cell carcinoma and we are going to attempt surgery, we can do one of two things. We can take an incisional biopsy, that is, incise a portion of the tumor and normal surrounding tissue and wait one or two days for the pathological diagnosis, or we can do a frozen section and get our report back in a matter of minutes and then carry out surgery. This may be a simple excision or a block dissection along with the draining lymphatics.

If we are going to separate the patient from his disease in one procedure and we note by clinical examination that there are metastatic nodes or that the tumor has spread beyond the primary site, it is necessary to remove the metastatic area in addition to the primary location. (Fig. 5.) In other words, if the tumor has spread to the lymph nodes in the cervical area, it is necessary to remove these nodes along with the primary tumor in order to separate the patient from his disease. There is no assurance that the tumor has not spread further if there is node involvement in the neck. However, we know that this procedure gives the best results.

Again, there are other methods of treating squamous cell carcinoma of the oral cavity. These methods are also aimed at separating the patient from his disease. But it must be realized that the diagnosis must be made first, then the tumor destroyed by excision or by the use of radiation or some form of chemical agent.

The malignant tumors of the bones of the maxillofacial area are the sarcomas. These are treated by radical or block excision of the bone and surrounding soft tissues, and occasionally block dissection of the lymph-draining area is done at the same time.

The next type of tumor is the lymphoma, or tumor involving the lymph nodes. These tumors, if treated early when they are confined to local areas, may be treated by surgery primarily. The surgical removal of the tumor and tissue *en bloc* gives very good results, especially when combined with radiation therapy. However, if the tumor is extensive, surgery is used only to make a diagnosis, and the lymphoma is treated with other types of therapy.

Malignant tumors of the salivary gland are treated by wide excision. Block dissection of the draining nodes is done only if there are metastases. We do not treat the malignant tumors of the salivary glands with routine node dissection, because in our experience they have not metastasized to the regional nodes as frequently as they have spread to the other parts of the body through the blood stream. The malignant tumors of salivary gland origin are mucoepidermoid carcinoma, adenocarcinoma and squamous cell carcinoma. Here again, if these are treated early by wide excision or complete removal of the gland involved with sufficient surrounding tissue, the survival rate is quite high. However, if the tumor is large and has infiltrated much of the surrounding tissue, the survival rate is low. The tumors of the salivary gland are not confined to the three major salivary glands, but may arise from any of the mucous glands lining the oral cavity. In our series we have seen more tumors in the aberrant salivary glands, so-called, than we have seen in the major salivary glands. This is due to the method of admitting patients in Cook County Hospital where patients with major salivary tumors are admitted to General Surgery and patients with intraoral tumors are admitted to the Maxillofacial Department.

FIG. 5. Surgical specimen removed from a patient with squamous cell carcinoma of the tongue and floor of the mouth, with attachment to the mandible and palpable nodes. The surgical procedure consisted of hemiglossectomy, hemimandibulectomy and neck dissection. There were four positive cervical nodes. The patient is alive and tumor-free six years postoperatively.

The tumor of the thyroid gland metastasizes quite commonly to the cervical nodes. Treatment is wide excision and complete removal of involved tissue. However, there is a difference in the treatment of the various types. The papillary adenocarcinoma of the thyroid is probably not as malignant as the carcinoma of the thyroid. The carcinoma is treated more vigorously than the papillary adenocarcinoma, which can be treated by removal of the involved nodes and the involved portion of the thyroid gland. There is considerable disagreement as to the treatment of papillary adenocarcinoma. We favor the more conservative approach because our survival rate has been good with conservative methods.

We will merely mention the metastatic tumors from other parts of the body involving

the maxillofacial area, since the treatment must be coordinate with the treatment of the primary tumors.

CONCLUSIONS

1. The maxillofacial area is the area above the clavicles excluding the eye, the central nervous system, and the middle and inner ear.
2. The surgical treatment of malignant tumors of the maxillofacial area is aimed at separating the patient from his disease.
3. The diagnosis must be made by histopathological study.
4. The squamous cell carcinomas of the oral cavity are multicentric.
5. There can be no set rule for the treatment of malignant tumors of this area. Each case must be considered individually.

The Open Method of Skin Grafting

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THIS article deals with what we believe to be the fundamental factors involved in free skin grafting as demonstrated under direct vision, i.e., the "open method."

Both methods have their spheres of usefulness in the broad field of free skin grafting.

We believe that success in free skin grafting depends upon the adhesion of the graft to the body by clot and does not depend upon the continuous pressure of bandages throughout the maturing period [7]. We do not believe that

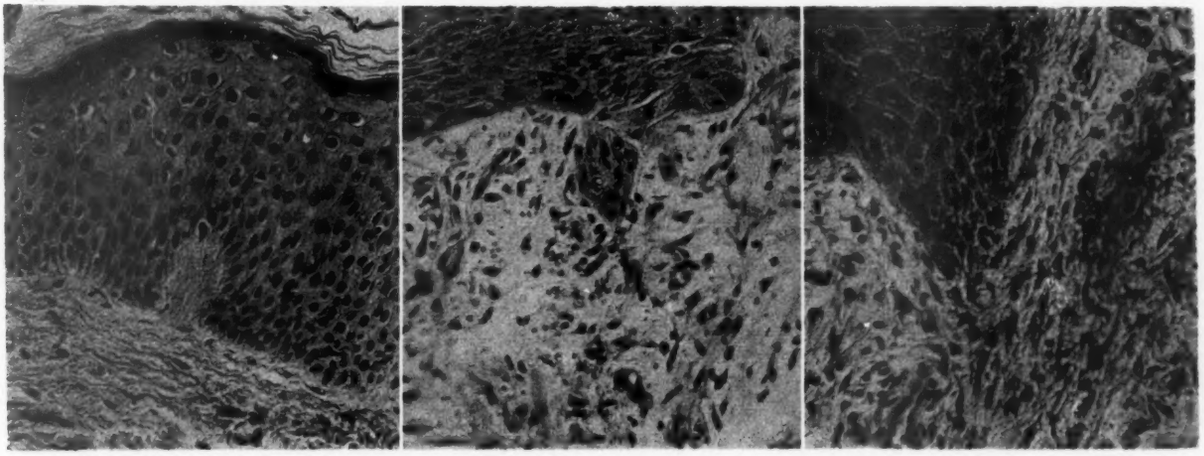

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FIG. 1. Biopsy of skin graft 15/1000 in thickness on recipient site two days postoperatively. Note flattened papillae and clear homogenous fibrin clot with few infiltrated fibroblasts immediately below graft. Original magnification, × 150.

FIG. 2. Biopsy specimen five days postoperatively. Note further infiltration of fibroblasts and capillary endothelium into fibrin clot beneath skin graft. Original magnification, × 250.

FIG. 3. Biopsy specimen twelve days postoperatively. Complete replacement of fibrin clot by fibroblasts and capillary endothelium. Original magnification, × 250.

We classify the broad operative subject of free skin grafting into two main methods: the open method and the closed method.

The open method uses no bandages over the grafts, and the process of healing can be seen from the time of application of the graft to its maturity [6]. The closed method utilizes bandages of various types associated with pressure. With this method, the process of healing cannot be seen. Advocates of this type of treatment believe that the pressure of the bandage is a necessary physical agent required for success. bandages in free skin grafting serve any physiologic purpose whatsoever. They may at times serve as physical agents to help contour the graft on an irregular recipient surface, or aid in protecting the free skin graft from trauma. Our experience has indicated that the question of controlling edema by bandages over the graft area is either erroneous or, if true, is unimportant.

In many areas of the body constrictive or pressurized bandages are dangerous. In other areas they are impossible. Examples of these

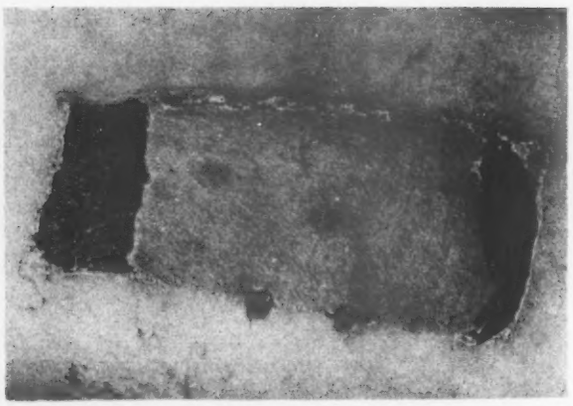


FIG. 4. Skin graft 15/1000 of an inch replaced on original donor site, twelve days postoperatively. Graft has taken completely. Areas on side of graft represent biopsy sites. The two areas in center of graft show complete resorption of small and medium sized blood clots.

are pressure over the eyeballs, nose, ears, cheeks, the neck (when negative pressure in the jugular vein is already present), the chest when constriction may impair respiration, the abdomen with its changing contours during digestion and the urogenital and anal regions for obvious reasons.

The open method is merely a method which affords greater elasticity in the treatment of injuries or diseases in which free skin grafting is indicated.

Surgically speaking, only two requisites are necessary for the growth of transplanted epidermis. (1) A surgically sterile dry bed for immediate epidermal adherence. (2) Once adhered to the body, the ever flowing springs of tissue fluid for its continued existence.

To determine the mechanics involved in the adherence of the grafts to the body we cut a split thickness skin graft 15/1000 of an inch in thickness. One portion of this graft was replaced on the original donor bed, and another portion on the recipient site. The grafts were then massaged into position. No dressing or pressure was applied. Biopsy specimens were taken every other day from both areas. (Figs. 1 to 3.) These specimens revealed a clear homogenous fibrin clot beneath the grafts, which was present from the time of application of the graft to the third day. (Fig. 1.) At that time, there was infiltration of the clot with young fibroblasts and capillary endothelium. The infiltration progressed (Figs. 2 and 3) so that by the twelfth day, there was complete replacement of the clot by fibrous tissue and capillaries.

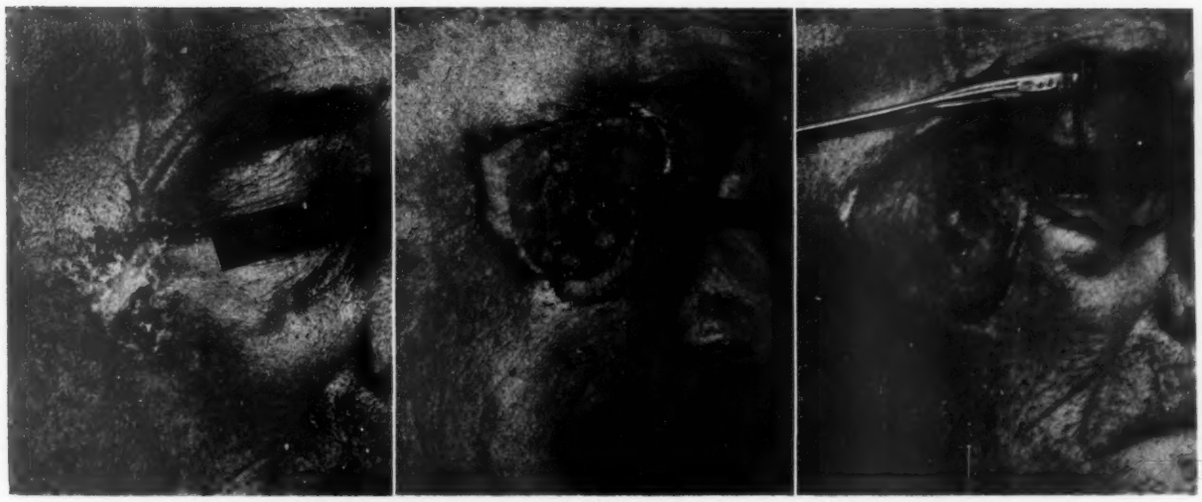
It is our opinion that the fibrin clot or "body glue" is the adherent force that firmly pulls the graft to the body surface; this is the only force necessary. It is the intrinsic pulling beneath the graft rather than the extrinsic compression that firmly seals the graft to the body. Once it is sealed, healing by fibrous union gradually supplants the temporary glue-like attachment of the fibrin clot. (Fig. 3.) All necessary substances for this adhesion are normally present on the surface of the skin graft and the wound [8].

Anything that prevents the graft from adhering to the body surface will cause failure. Devitalized tissue, foreign bodies or a large blood clot may do this. To investigate this point we gathered large, small and medium sized blood clots from the donor site and placed them beneath various grafts. We found that clots of very large size set up a foreign body reaction followed by a collection of serum beneath the graft. This serum lifted the graft from the body surface. If the serum and a portion of the clot were evacuated by the third day, the graft could be saved. This was done by incising the bleb and resealing the graft to the recipient site. If this was not done, the seal remained permanently broken and the graft sloughed. Small and medium sized blood clots did not affect the seal of the graft. These clots were gradually absorbed by the twelfth day and the grafts were successful. (Fig. 4.)

The size or thickness of a split thickness skin graft is no criteria for a "take." The open method of grafting has been successful using sheets of skin over a large area, or grafts the size of postage stamps over small areas. Thick split grafts which contain more elastic fibers may be sutured to the periphery of the wound to prevent retraction. Thinner grafts require no sutures.

Any area subject to trauma or which can be protected from trauma, and which is not subject to acute or twisting movement can be treated by the open method. Soft undulating movements do not interfere with success in this method of free skin grafting. Once the graft is fixed (an action which takes place soon after application), motion around the periphery of the wound will not dislodge it from its bed or cause wrinkling.

It is interesting to note the color changes within the graft using the open method. On application, it is pinkish white in appearance.

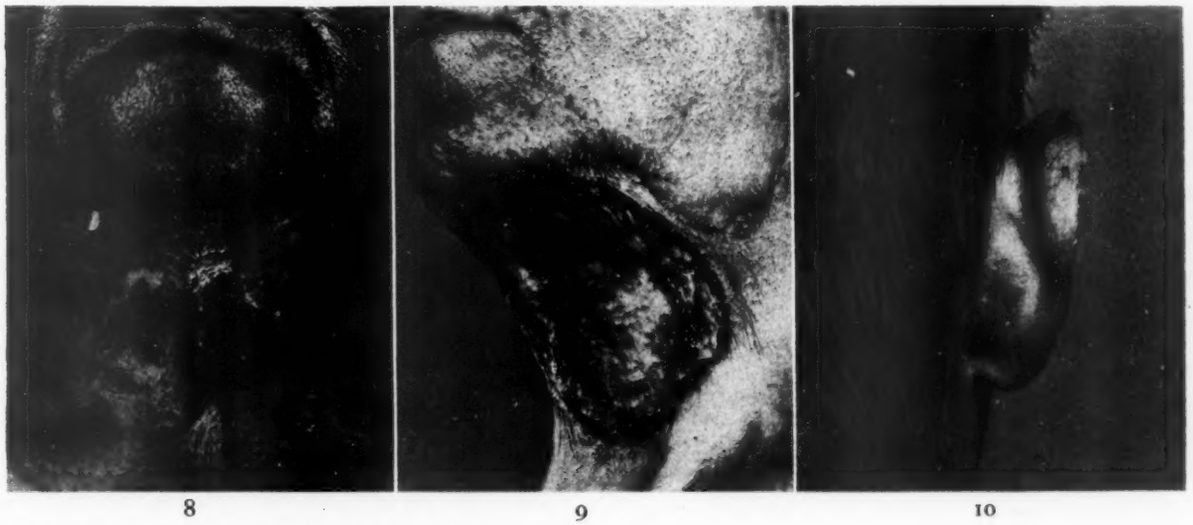


5 6 7

FIG. 5. Basal cell carcinoma of face preoperatively.

FIG. 6. Immediate postoperative skin graft following excision of basal cell of face. Note no sutures or dressing. There is some overhang inferiorly which does not affect the graft.

FIG. 7. Patient twelve days postoperatively. Complete take of skin graft. Patient wore glasses from first postoperative day.



8 9 10

FIG. 8. Epidermoid carcinoma of neck in scar contracture.

FIG. 9. Twelve days postoperatively showing complete take. Excision of carcinoma and scar area of neck. Graft was applied to hyoid bone, thyroid cartilage and pretracheal fascia. Graft was sutured to superior margin only. No dressings were used.

FIG. 10. Patient twelve days postoperatively with third degree burn of ear. Graft applied without sutures or dressing. Note complete take.

After twenty-four hours it may change to a dark purple. Small blood clots may be seen interspersed beneath the graft. The duskiness gradually clears so that by the sixth postoperative day it is a mottled pink.

Figures 5 to 12 will illustrate some of the areas in maxillofacial surgery in which the open method of skin grafting has been used successfully.

Some of the advantages of the open method of grafting are as follows:

(1) The graft is under direct vision at all times so control is absolute. Foreign body serum blebs may be detected at once, incised, and

11 12

FIG. 11. Preoperative basal cell extending to forehead, temporal region and upper-lower eyelid.

FIG. 12. Patient one year postoperatively. Application of graft by open method.

resealed with prevention of unnecessary tissue loss. (2) The patient requires little attention. (3) Operating time is cut to a minimum, as in most cases we use no sutures as well as no bandage. (4) Use of material and trained personnel is cut to a minimum. (5) Early mobilization of the patient is possible in most cases of grafts above the abdomen. (6) The method obviates the difficult bandaging problems. (7) The shocking experience to the patient caused by removing extensive bandages is prevented. (8) Lack of heat and moisture helps the wound to dry quickly and prevents infection. (9) There is little chance for confined infection to destroy graft tissue [*10*].

SUMMARY

The open method of free skin grafting utilizes no bandages and, on most occasions, no sutures. This method is physiologically correct as it depends upon the intrinsic adherent forces of the fibrin clot beneath the graft for its seal. Once sealed by the clot, the infiltration of fibrous connective tissue and capillaries complete the fibrous attachment. Pressure bandages are not necessary. In some areas, they are impossible to apply and in others they are dangerous. Small and medium sized blood clots beneath the graft do not affect the take. The size or thickness of the graft has no bearing on the take. Some advantages of the open method of skin grafting are mentioned.

Acknowledgment: The author wishes to thank Dr. John A. Jenney, New York, N. Y., for his cooperation in evaluating the efficacy of the open method of free skin grafting. His basic research prompted our further study of this problem.

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Osteomyelitis of the Jaws in Infants

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OSTEOMYELITIS of the jaws affecting an infant may be a serious disease.

A recent case of osteomyelitis of the mandible in a six month old infant prompted a study of cases encountered at the University of Michigan Hospital and St. Joseph's Mercy Hospital, Ann Arbor, Michigan. This case is reported in detail with a review of five other cases.

Klementowsky [1] in 1876 first described osteomyelitis in infants. In 1954 Thoma [2] stated that as few as eighty cases were reported in the literature. Wilensky [3] considers osteomyelitis of infants and nurslings to be a distinct entity because of the extraordinary manifestations. The disease may result in destruction of tooth buds and growth centers with severe developmental deformities of the face in later life.

The differential diagnosis of swelling about the face in infants (children under two years of age) includes infection, neoplasia, and hyperplasia (infantile cortical hyperostosis) or Caffey's disease [4].

This review includes examination of 142 patients in all age groups at the University of Michigan Hospital for a twenty-three-year period (1934 through 1956) and twenty-eight patients in a period of thirteen years (1944 through 1956) at St. Joseph's Mercy Hospital, Ann Arbor, Michigan. Of the 142 cases at the University Hospital, nineteen patients were fifteen years of age or younger. Of the twenty-eight cases at St. Joseph's Hospital four patients were under fifteen years of age. In a period of twenty-three years at the University Hospital four infants were treated, while in a thirteen-year period at St. Joseph's Hospital two were treated. The greater number in the two to fifteen year age group at the University Hospital is probably due to a larger dental service where most of these cases were diagnosed as localized osteomyelitis due to dental caries.

In six cases of osteomyelitis of the jaws in infants, five affected the mandible while only one involved the maxilla. The youngest of the six patients (one month) had involvement of the maxilla. Three were males and three were females.

INFANT GROUP

(6 CASES - 3.5% OF 170 CASES)

UNIVERSITY OF MICHIGAN HOSP. & ST. JOSEPH MERCY HOSP.

PATIENT	AGE	MALE	FEMALE	MANDIBLE	MAXILLAE
E.S.	1 month		X		X
R.T.	3 months		X	X	
K.K.	3 months		X	X	
S.B.	6 months	X		X	
L.R.	12 months	X		X	
J.U.	24 months	X		X	
TOTAL 6		3	3	5	1

FIG. 1. Chart of statistics: Infant group.

Of a total of 170 patients with osteomyelitis of the jaws seen over a total number of thirty-six years (567,509 hospital admissions), 3.5 per cent were infants. (Fig. 1.)

Etiologic factors predisposing to osteomyelitis were nasal drainage since birth, otitis media, pneumonitis with empyema of the thoracic cavity, an oral necrotic tumor (lymphangioma), trauma to an extremity, measles and furuncles of the chin. The most frequent organisms encountered were hemolytic staphylococcus aureus, beta hemolytic staphylococcus and alpha streptococcus. Hematogenous dissemination most likely accounted for all the osteomyelitis in the infant group.

The clinical signs in the case of the infant with involvement of the maxilla were marked swelling of the periorbital tissues and cheek with pronounced redness and pus. The infants with involvement of the mandible showed swelling of the cheek and tissues over the body and

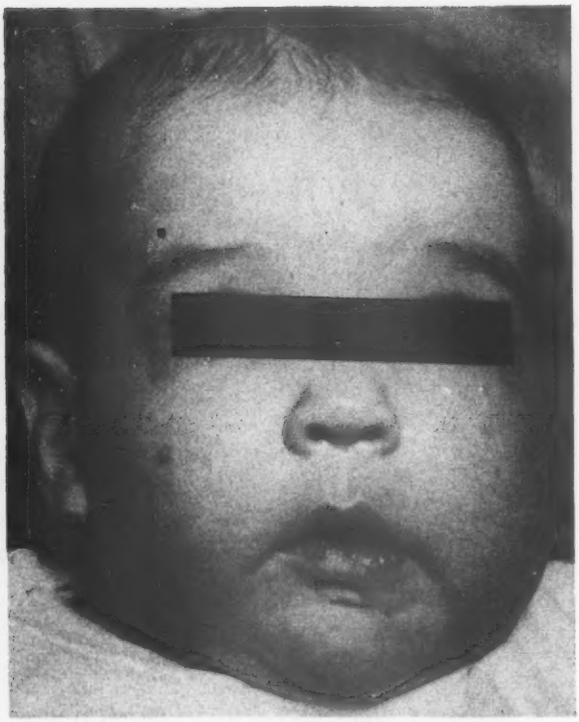

FIG. 2. Six month old infant with swelling of left side of face. Note scar on chin resulting from ruptured furuncle.

ramus of the mandible and parotid region. One showed an extraoral fistula at the angle of the mandible and one had a tumor of the lip and tongue (lymphangioma) with necrosis.

In the youngest patient there was extensive destruction of the maxilla including the infra-orbital ridge. The affected mandibles showed widespread destruction of the body or ramus or both.

All cases presented the classic findings of infection, leukocytosis and elevation of temperature. Poor nutrition and anemias were noted almost consistently.

The treatment of choice is the early use of a wide-spectrum antibiotic drug until specific organisms can be isolated and sensitivity studies carried out. General deficiencies should be corrected with blood transfusion and protein and vitamin supplements. Incision and drainage is mandatory if a fluctuant abscess develops, and careful sequestrectomy should be done when loose necrotic bone is present. Early radical surgery leads only to spread of infection and greater loss of tooth and bone structure. Careful sequestrectomy will permit maximum reconstitution of mandibular and maxillary contour.

CASE REPORT*

S. B., a six month old white male infant, was admitted to St. Joseph's Mercy Hospital on February 19, 1956, because of a markedly swollen left cheek. Approximately three months prior to admission furuncles had developed in the region of the chin. These ruptured and drained externally through small sinuses. After drainage subsided from the furuncles of the chin, drainage was noted intraorally from the left body of the mandible. Swelling became progressively worse in the left cheek and neck.

The infant was seen by a number of examiners who believed this represented a cyst of the body of the mandible. The past history was unremarkable except that the infant had had an insufficient diet and was still maintained principally on a milk formula without supplementary foods.

Physical examination revealed a six month old infant with a markedly swollen left cheek. The area was not painful. The mass was firm with no fluctuation. Several small scars were present on the chin. (Fig. 2.) The remainder of the physical examination was normal.

Urinalysis was normal and the blood count varied from 10,000 to 13,350 white blood cells per cu. mm.; the hemoglobin was 62 per cent and 64 per cent on two occasions, with evidence of hypochromic anemia. The patient's temperature fluctuated between 99.6° and 101°F. rectally.

X-ray films of the mandible revealed marked enlargement and deformity of the left side with dense sclerosis of the body from the ramus to the symphysis. The left ramus was not visualized and was thought to have been destroyed. A number of the teeth on this side appeared to be partially extruded from the bone. (Fig. 3A and B.) Clavicles and upper ribs which were also visible on these films showed no evidence of hyperostosis.

On February 29th sequestrectomy of the mandible was carried out under endotracheal ether anesthesia. This was performed intraorally with an incision made over the crest of the ridge of the mandible in the molar region. Mucoperiosteum and soft tissue were elevated. There were many sequestra which were removed along with several tooth buds and granulation tissue. The postoperative diagnosis was osteomyelitis of the mandible.

* Courtesy of Dr. Philip M. Northrop.

3A 3B

FIG. 3. A and B, anteroposterior and lateral films of mandible exhibiting osteomyelitic destruction of the ramus and a portion of the left body with extrusion of teeth. There is a concomitant proliferative process of the left body.

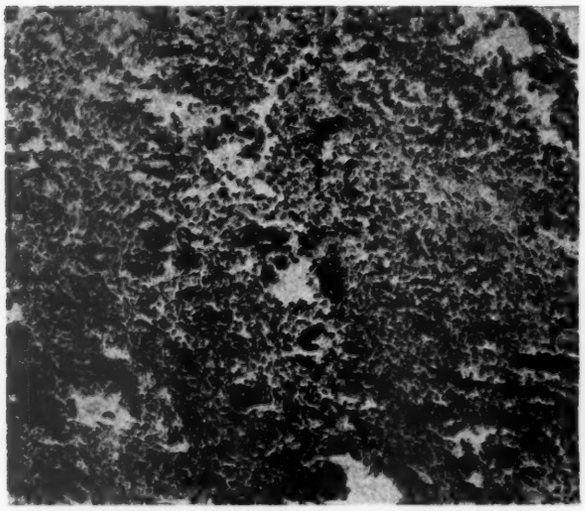

FIG. 4A. Vascular pyogenic granulation tissue overlying mandibular lesion.

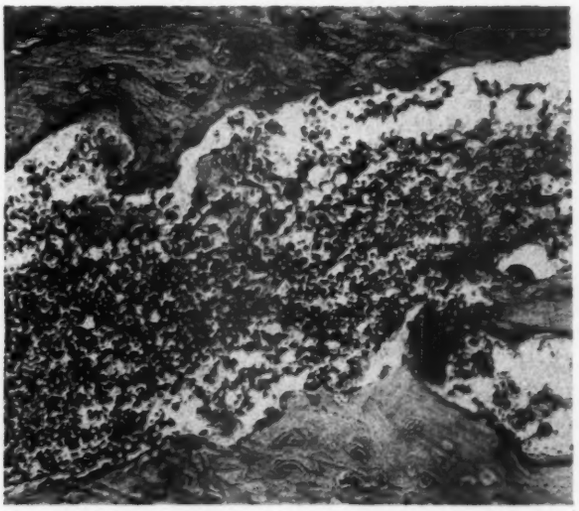

FIG. 4B. Sequestrum from left body of mandible.

Microscopic section of the soft tissue showed slightly hyperplastic stratified squamous mucosa, revealing edema, overlying fibrous tissue submucosa. The submucosa exhibited proliferating capillaries and fibroblasts with an infiltration of histiocytes, lymphocytes, plasma cells and neutrophils. A small amount of scar and undecalcified irregular bits of bone were identified. The conclusion was sequestra of bone with chronic purulent inflammation. (Fig. 4A.)

Bacteriologic study revealed the presence of hemolytic staphylococcus aureus and alpha streptococcus organisms; these were highly sensitive to chloromycetin and therefore this drug was used in treatment.

The patient was discharged from the hospital on March 4th and readmitted on July 25th. The mother stated that two weeks previously the infant's jaw had begun swelling again on the left side, with development of a soft, purple mass about 2 cm. in diameter over the masseter muscle. Physical growth had been excellent.

Examination revealed a well developed child whose face was swollen on the left side. There was limited mobility of the mandible. A soft,

FIG. 5. Current x-ray film of left mandible.

purplish area approximately 2 cm. was present over the left masseter region.

There was little change in bony architecture on x-ray examination, except for slight increased density of the body of the mandible. The molars on the left were extruded.

Increase in size of the mass and a fistulous opening anterior to the ear were indications for further surgical intervention, which was carried out on August 3rd. A mass of granulation tissue was encountered at the posterior border of the mandible. A probe inserted extraorally through the fistulous tract extended into the ramus. Granulation tissue was carefully curetted and a small sequestrum removed. The tissue within the mouth was closed with sutures.

A decalcified microscopic section showed cortical and cancellous bone with "moth-eaten" eroded borders and loss of nuclear staining of the osteocytes. Partially necrotic purulent exudate and colonies of bacteria were noted. The conclusion was sequestrum from chronic osteomyelitis. (Fig. 4B.) Hemolytic staphylococcus aureus was isolated and highly sensitive to erythromycin. This drug was an adjunct in the treatment.

The patient was discharged on August 16th with an uneventful postoperative course. The fistulous tract had closed.

A report of a recent examination elsewhere indicates that the infant's general physical development is excellent. The facial contour is nearly symmetrical, the bone is firm with no immobility of the mandible.

An x-ray film taken on April 30, 1957, shows some reduction in the size of the left mandibular shadow with rounding off of the previously diseased posterior end of the body. The bony trabecular markings are more apparent than originally. There are still two deformed tooth buds in the posterior end of the remaining mandible. (Fig. 5.)

SUMMARY

1. Six cases of osteomyelitis in infants (children under two years of age) are reported.

2. Study of 170 cases of osteomyelitis of the jaws in patients in all age groups at two institutions for a total number of thirty-six years (567,509 hospital admissions) reveals that 3.5 per cent of the patients were infants.

3. A case report of the most recently treated infant is presented in detail.

4. The treatment of choice is the use of antibiotics, nutritional supplements and surgery.

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Fibrous and Granulomatous Lesions of the Jaw Bones

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THE jaw bones on occasion are the site of abnormal areas of varying extent which roentgenographically may vary from well circumscribed "cystic" areas to more or less diffuse involvements showing alternating areas of radiolucency and radiopacity. When other specific neoplasms and cysts are excluded by biopsy these lesions will show essentially fibrous tissue, with or without the presence of giant cells and with or without areas of new bone or osteoid formation. These benign lesions of the jaw comprise an interesting and challenging group. A wide variety of terms have been used to designate some or all of the lesions in question. Some of these terms are fibrous dysplasia, osseous dysplasia, osteitis fibrosa cystica, ossifying fibroma, osteogenic fibroma, nonosteogenic fibroma, osteofibroma, cementoma, cementifying fibroma, fibro-osteoma, giant cell tumor, giant cell reparative granuloma, giant cell lesion and there are undoubtedly others. This wide variety of terms represents varying concepts of the nature and pathogenesis of these lesions. This confusion in terminology and concepts has caused considerable difficulty for both the surgeon and pathologist.

One of the major problems is to decide whether or not all of these lesions should be placed into one or two great categories or if subdivision is necessary and indicated, how many subclassifications are justified. In this respect one peculiarity of pathologists must be considered. Pathologists, who seem to delight in classifying things, have themselves been classified as "lumpers" and "splitters." In reference to the problem at hand, we have those who would place all the lesions in question under the general heading of fibrous dysplasia. This can be defined as "lumping" in the extreme. This approach, however, does offer some interesting possibilities. As far as the pathologist is concerned, he can streamline his filing system considerably.

However I believe that some degree of splitting is justified. I believe that the use of "fibrous dysplasia" in this all-inclusive sense violates the historical concept of the condition and places dissimilar lesions under one heading.

It appears that there has been a recent tendency of many experienced pathologists to restrict the use of the term fibrous dysplasia to a rather specific disorder in which there are rarefying changes in the bone, usually polyostotic in nature, abnormal cutaneous pigmentation, disturbances in skeletal growth and expressions of endocrine dysfunction in women [1]. Some authorities have challenged the concept of monostatic fibrous dysplasia [2].

In this connotation an excellent story is told. "Some years ago every laboratory had a wastebasket for unclassifiable bone lesions. The label on the wastebasket read 'osteitis fibrosa.' Today the label has been changed to 'fibrous dysplasia.'"

I would like to discuss briefly and illustrate some of the concepts which we use in the diagnosis of these fibrous and granulomatous lesions of the jaw in our laboratory. Most of these ideas are not original with me but I have found these concepts convenient and workable. The classifications for this group which we are using are: (1) fibrous dysplasia, (2) ossifying fibroma, (3) osseous dysplasia, (4) giant cell lesions "benign giant cell tumor?", and (5) cherubism.

FIBROUS DYSPLASIA

We have been restricting the use of this term to fibro-osseous enlargements of an obviously developmental nature. This, I believe, is more in line with the original concepts of Albright,

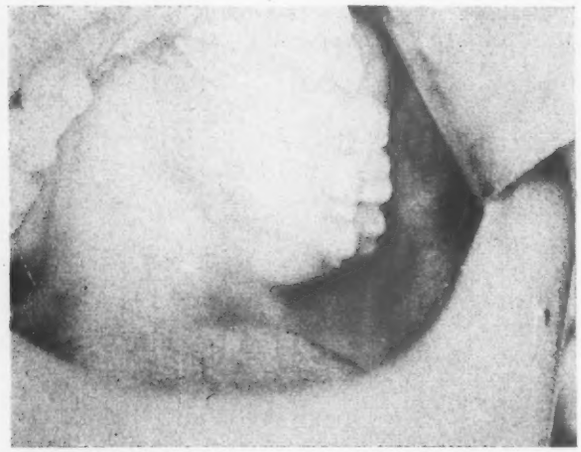

FIG. 1. A diffuse enlargement of the right maxilla of an eighteen year old boy. This condition had developed slowly over a period of years. Radiographs showed a diffuse bone involvement with a ground glass appearance.

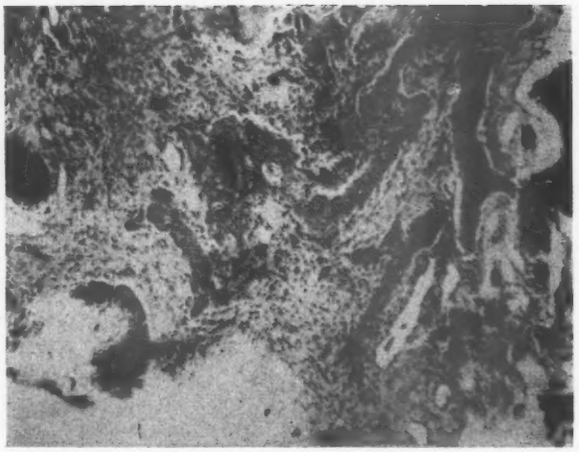

FIG. 2. Low power photomicrograph of biopsy of maxilla showing replacement of normal bone with fibrous tissue containing irregular trabeculae of irregular bone.

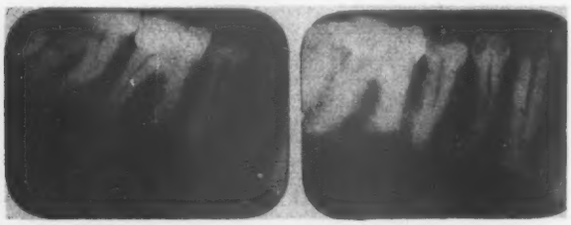

FIG. 3. Dental radiographs showing a well circumscribed, radiolucent defect of the mandible of a fifty-seven year old man. At operation, a well encapsulated, firm tumor was removed.

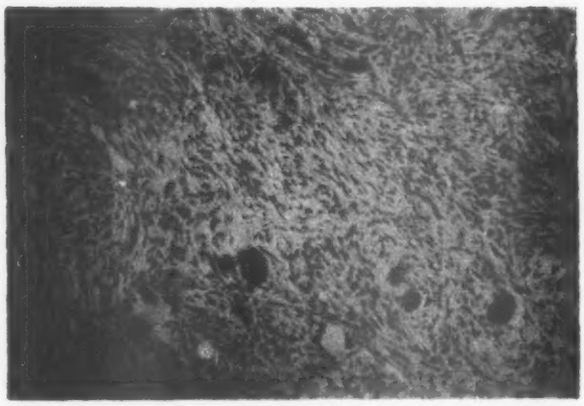

FIG. 4. Photomicrograph (medium power) of lesion showing whorls of fibroblasts with focal calcified areas.

Lichtenstein and Jaffe [3,4]. These hamartomas are most often observed in younger patients although lesser involvements may not be detected until later in life. There appears to be a definite tendency for stabilization of growth of these lesions when skeletal growth ceases [5]. Roentgenographically the process tends to be diffuse and poorly limited. It presents as a rarefying process in bone with a marked tendency toward involvement of more than one bone. Older lesions tend to show a greater degree of calcification. (Figs. 1 and 2.)

The treatment of fibrous dysplasia involving the jaws presents many problems, particularly if the involvement is extensive. Conservative surgery for cosmetic purposes after a period of watchful waiting has been generally employed. A few isolated reports of malignant change in such lesions have appeared but some of these cases may be open to question [6].

OSSIFYING FIBROMA

We believe that this lesion may be properly considered as a benign neoplasm which arises in the spongiosa. Cases have been observed over a fairly wide age range. The tumor tends to be well circumscribed and may be encapsulated. Radiographically it presents as a sharply circumscribed radiolucent defect containing small to large radiopaque areas [7]. Microscopically these lesions are composed of bundles of fairly active-appearing fibrous tissue with small nodular areas of calcification or areas of poorly formed bone. (Figs. 3 and 4.) On occasion these lesions have shown a great growth potential and for that reason surgical excision is recommended. Some authors also use the term fibro-osteoma to designate a benign neoplasm of this type, in which a more mature form of bone is produced by the tumor cells [8]. I have never found this term useful and believe it adds unnecessarily to the classification.

FIG. 5. Dental radiograph showing an abnormal area in mandible of a thirty-five year old woman. Microscopic examination showed fibrous tissue containing numerous irregular bone trabeculae. This type of lesion is considered to be a reaction of bone to injury (osseous dysplasia). It would not appear to be a developmental error nor a neoplasm.

OSSEOUS DYSPLASIA: REACTION OF BONE TO SURGERY

The oral diagnostician frequently observes atypical areas on roentgenographic examination. For the most part these areas are asymptomatic and are usually discovered during routine radiographic examinations. If these areas are surgically explored and the material examined histologically, they will be found to be composed of varying amounts of fibrous tissue, calcified material and often giant cells. On the basis of a small biopsy, differentiation from fibrous dysplasia or ossifying fibroma may be difficult if not impossible. However, when the total picture is examined, it is very difficult to consider these areas as either developmental lesions or as neoplasms. Robinson [9] has used the term osseous dysplasia for lesions of this type, suggesting that this represents a reaction of bone to injury. These areas are frequently observed near the apexes of teeth subjected to occlusal trauma (so-called cementomas) or in edentulous areas following extractions. It is certainly justifiable to separate this group of lesions from fibrous dysplasia and from ossifying fibromas and the designation osseous dysplasia appears to be adequate for this. (Figs. 5 and 6.)

GIANT CELL LESIONS

The giant cell tumor of bone is still one of the more controversial lesions in pathology al-

FIG. 6. Abnormal bone pattern in lower anterior region. The teeth were vital and asymptomatic. This lesion is often called a cementoma.

though in recent years there appears to be an increasing unanimity of opinion on what constitutes a giant cell tumor [10]. On occasion, lesions which closely resemble the giant cell tumor of long bones are seen in the jaws. On close inspection, however, these lesions for the most part are not histologically identical with the true giant cell tumor of long bones. Clinically, also, these lesions do not demonstrate the aggressive features of the tumors of long bones. Jaffe [11] has recently suggested the term "giant cell reparative granulomas" for these lesions. A small percentage of these lesions, however, appear more active on microscopic examination and closely resemble the lesion seen in the long bones. In the cases we have followed up, the clinical course has been quite benign [12]. Until a better understanding of this interesting lesion has developed, I prefer to designate them as "giant cell lesions" of the jaws.

CHERUBISM

In 1933 Jones [13] reported on peculiar bilateral mandibular bone lesions occurring in four of five children of one family. These cases

FIG. 7. Anteroposterior roentgenogram of a nine year old girl, who presented with firm, bilateral swellings of the mandible. The condition had been noted for two years. Her older sister was similarly affected.

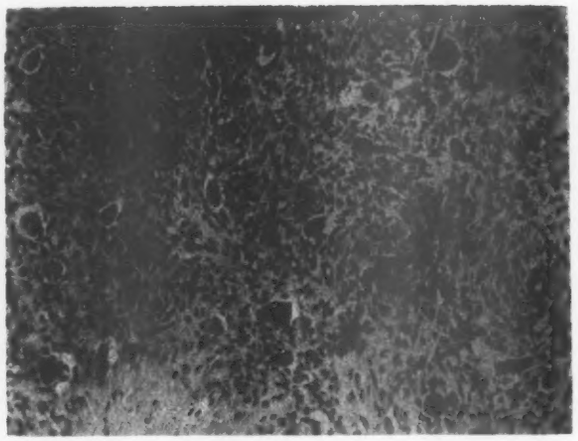

FIG. 8. Photomicrograph (medium power) of tissue removed by curretage from these lesions. The histologic features are identical with the giant cell lesions (giant cell reparative granulomas) which are not associated with cherubism. (From: WALDRON, C. A. *Oral Surg.*, 4: 198–207, 1951 [*15*].)

were reported under the title of "Familial Multilocular Cystic Disease of the Jaws." Gerrie [*14*] at the 1949 meeting of this Society reported the further developments in these patients and used the term "cherubism" to describe the condition. Since Jones' original report, cases involving eighteen additional individuals in ten family groups have appeared in the literature [*15–20*]. These lesions have been variously termed "bilateral giant cell tumors," "familial fibrous swellings of the jaws," "disseminated juvenile fibrous dysplasia of the jaws," "familial fibrous dysplasia of the jaws," and "familial intraosseous fibrous swellings of the jaws." Within the last few years I have had the opportunity to examine histologic material and the clinical records of four additional unreported cases.

Clinically this condition usually appears fairly early in life and, in its full-blown state, the person affected with these bone lesions will show a marked bilateral prominence in the posterior mandibular area and expansion of the ascending ramus and alveolar process. The roentgenograms show extensive radiolucent changes which tend to have a multilocular appearance. (Figs. 7 and 8.) I have examined the sections from ten patients with this condition. These show a loose arrangement of fibroblasts and numerous multinucleated giant cells. New bone formation is absent or only very sparse. This is not the picture of fibrous dysplasia, unless one is using the term in a very broad and loose sense. Neither is it the picture of true giant cell tumor. The lesions appear identical with the solitary giant cell lesions (giant cell reparative granulomas) of the jaws.

Until more experience has accumulated, I think it is well to separate the cases with this distinctive clinical pattern and to use the noncommittal designation of cherubism for them. The prognosis appears good and excellent results have been reported after conservative surgical intervention.

Much still remains to be learned about these fibrous and granulomatous lesions of the jaws. It is possible that the working classification presented here will be greatly modified in the light of future knowledge. All the lesions under question have many points of similarity, as well as certain differences. Proper diagnosis and intelligent treatment should be based on the combined efforts of the surgeon, radiologist and pathologist.

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The Role of the Posterior Pharyngeal Flap in Rehabilitation of the Patient with Cleft Palate

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CAREFUL follow-up in a well integrated cleft palate rehabilitation clinic does much to chasten and discipline our approach to each individual problem case. In this clinic the egos and personalities of the various specialists must be submerged in the consideration of the welfare of the patient. Just as the plastic and maxillofacial surgeon must call on the services of the prosthodontist, orthodontist, speech therapist and pediatrician, so are there times when he will have to call for surgical care. An obturator is successful as long as there are sufficient teeth to provide good anchorage; but, as has been demonstrated so frequently, the wearing of an obturator is frequently followed by erosion, caries and loosening of the teeth. Once these are lost, the patient's entire world built around the successful use of a prothesis is shattered and it is at this point when the plastic and maxillofacial surgeon is again asked to enter the picture. In addition, we are also being faced with an increasing number of instances in which, as the patients lose their teeth due to malocclusion and dental caries, the problem of retaining a satisfactory prothesis becomes an increasingly difficult one.

Over seven years ago we became interested in the posterior pharyngeal flap as one of the aids to meet this challenge. Prior to starting our work, a review of the literature showed that originally Trendelenburg [*1*] conceived the idea of using a pharyngeal flap to lengthen the soft palate. He experimented successfully with it in animals. Passavant [*2*] in 1865 and Schonborn [*3*] in 1876, cognizant of Trendelenburg's work, tried a type of pharyngeal flap operation. The operation fell into disuse until 1924 when Rosenthal [*4*] combined the posterior pharyngeal flap with a modified von Langenbeck palatoplasty. In 1927 Fründ [*5*] combined the Schonborn-Rosenthal methods. In 1932 Precechtel [*6*] reported improvement in the speech of ten of twelve patients treated with velopharyngorraphy. In 1933 Meissner [*7*] reported four cases with good results. Sercer [*8*] in 1935 believed the best correction of nasality in old scarred palates was obtained by the palatopharyngorrhaphy (Schonborn and Rosenthal) and thought that the functional revival was due to regeneration of nerve supply in the atrophic palate. Rosselli [*9*] in 1935 modified the Schonborn operation basing the flap above. Roviralta Astoul and Abades Blanchart [*10*] in 1947 combined the operation of Veau and Rosselli. In 1949 Marino and Segre [*11*] reported the use of the Dorrance push-back and the pharyngeal flap to insure retention of the palate in its backward position.

Padgett [*12*] was the first to use the method in this country. In 1930 he reported on sixty-eight posterior pharyngeal flap operations as an aid to closure of large defects of the soft palate. In fifty-two of these, complete closure was obtained. In 1951 Conway [*13*] and Moran [*14*] reported their respective works relative to the improvement in speech noted by the use of the posterior pharyngeal flap with or without the set-back operation. As pointed out by Moran, the flap operation does not in any way impede or alter the maxillary development which is a frequent sequel to other palate surgery. Dunn [*15*] has reported on the improvement in speech in thirty patients with poor

speech on whom he has used the posterior pharyngeal flap. In 1952 Ivy [*16*] made the statement: "It may be that revival of the pharyngeal flap procedure will provide the answer for some of these cases, unamenable to the more conventional surgical methods." Fogh-Anderson [*17*] reported the use of the pharyngeal flap in seven problem cases. Walden, Rubin and Diecidue [*18*] advised preliminary tracheotomy to provide better exposure, and reported successful closure in eleven of thirteen cases. Webster, Coffey and Russell [*19*] reported on the use of Langenbeck's hard palate closure combined with the pharyngeal flap procedure.

We have performed the posterior pharyngeal flap procedure with and without retropositioning of the palate on fifty-two patients for the following conditions: (1) paralysis of the palate (bulbar polio), two cases; (2) rhinolalia aperta due to submucous cleft with failure of fusion of the muscles, two cases; (3) congenital foreshortening of palate (apparent after adenoidectomy), two cases; and (4) scarred, foreshortened palates following cleft palate repair, forty-six cases.

In all the foregoing cases there was marked nasal escape with typical cleft palate speech—many of the patients could scarcely be understood. In the younger age group only two operations were performed on patients under the age of five, and this was done for paralysis of the palatal muscles with marked reflux of food through the nose. Nine operations were performed in the pre-school group to aid in the correction of extensive palatal defects. The patients were then given speech therapy. As a result there was marked improvement in their speech prior to starting school. There were sixteen patients in the secondary school group, many of whom had been held back by their poor, almost incomprehensible speech. A large percentage of this group had previously had speech therapy without results. Following the repair with a posterior pharyngeal flap immediate improvement was noted in their speech. Only a minimum of speech therapy was required to correct their old speech habits. It was gratifying to see the large number of this group who were completely rehabilitated, who became active in their school activities and developed into hard-working scholars, as was evidenced by their rapid advancement.

CASE REPORTS

CASE I. S. S., a two and a half year old child, had difficulty in speaking and was troubled with reflux of food from her nose. The palate was foreshortened and atrophic, and did not move on gagging. (Fig. 1.) There was a distance of 2 cm. from the posterior pharyngeal wall to the uvula. Nasal escape was very marked. A posterior pharyngeal flap (3 by 2 cm.) was elevated with a pedicle based upward. The palate was lengthened by turning down a hinged flap from the nasal side of the soft palate. The posterior pharyngeal flap was then rotated and sutured into this defect, thus effectively correcting the defect. (Fig. 2.) Difficulty in speaking and foods coming out of the nose were corrected by this procedure.

CASE II. R. M., a twelve year old boy, had had a Brophy type of repair for a unilateral palatal defect at the age of twenty-four months. In addition to his middle third facial deformity (Fig. 3) the patient had such poor speech that he was kept in an ungraded special Catholic school. The boy was very glum and morose. Three years before the present admission, in addition to reconstruction of the middle third facial defect, a posterior pharyngeal flap (5 cm. in length and 3 cm. in width) with its flap based above had been elevated. The palate was lengthened by turning a hinged flap from the nasal side of the soft palate. Raw areas were epithelized by insertion of the two flaps with mattress sutures. (Fig. 4.) At present there has been a tremendous improvement in the patient's personality. Instead of being shy and retiring he has now developed an outgoing personality, is happy and has made great advances in his schoolwork as the result of his improvement in speech.

CASE III. M. B., a thirty-two year old woman, had marked cleft palate speech due to marked foreshortening of the palate. (Fig. 5.) A partial cleft of the palate had been repaired when she was fifteen years of age. The pharynx was wide open and patient had marked nasal escape. A posterior pharyngeal flap (5 by 3 cm.) was inserted into the defect created by lengthening of the palate with a hinged flap raised from the nasal side of the soft palate. The patient (Fig. 6) noted immediate improvement in her speech. Therapy was given to correct the old speech habits. There was no nasal

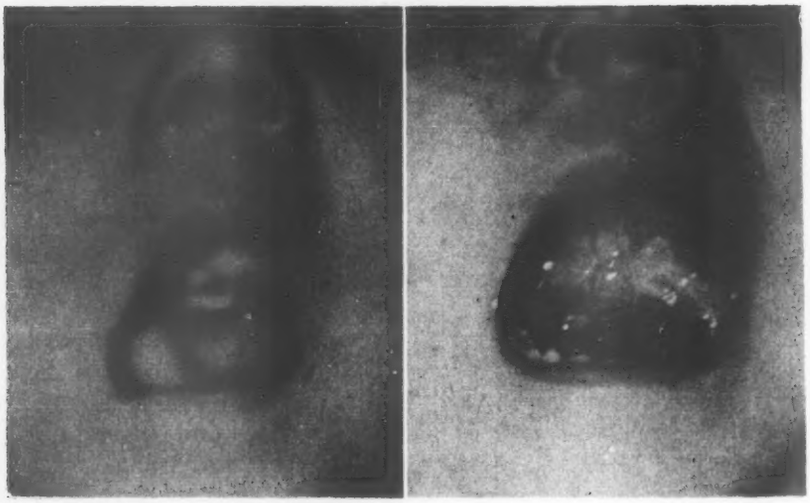

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FIG. 1. Case 1. Two and a half year old child whose palate was foreshortened, atrophic and paralyzed. Nasal escape was marked and the patient suffered from reflux of food through the nose.

FIG. 2. Case 1. Two years after lengthening of the palate with hinged palatal flap and posterior pharyngeal flap. Palate is no longer paralyzed and atrophic. Its movement is excellent and as a result the nasal escape is corrected and there is no longer any reflux of food through the nose.

3 4

FIG. 3. Case 11. Twelve year old boy who was glum and morose, and had such poor speech he was kept in a special ungraded school. Note the scarred, atrophic palate along with middle third facial deformity following a Brophy type of repair.

FIG. 4. Case 11. Three years following lengthening of palate by turning a hinged flap from the nasal side of the palate and anchoring into the raw area a posterior pharyngeal flap based above. In addition the facial deformity was corrected. The patient is now happy, speaks very well and has made great advances in his school work.

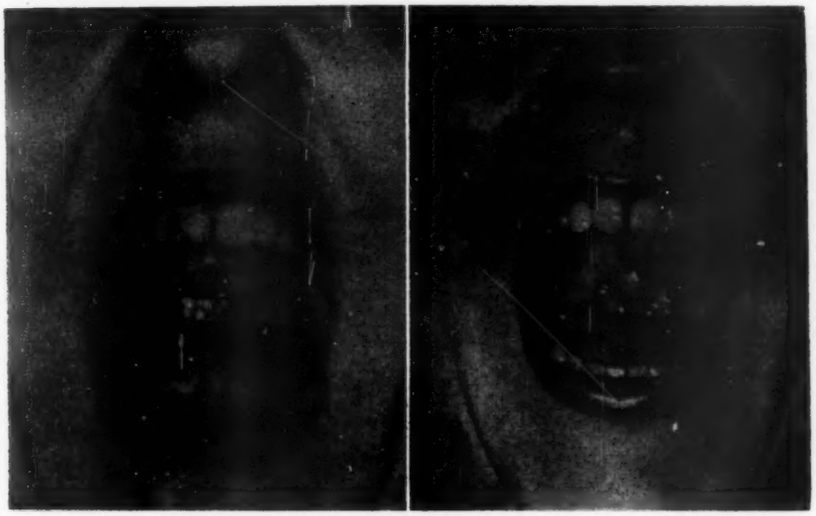

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FIG. 5. Case III. Thirty-two year old woman with marked cleft palate speech due to foreshortening of the palate following the repair of a soft palate when she was fifteen years of age. There was marked nasal escape.

FIG. 6. Case III. Two years following reconstruction with posterior pharyngeal flap. As a result of developing normal speech the patient has taken a new lease on life and has been given advancements in position and salary.

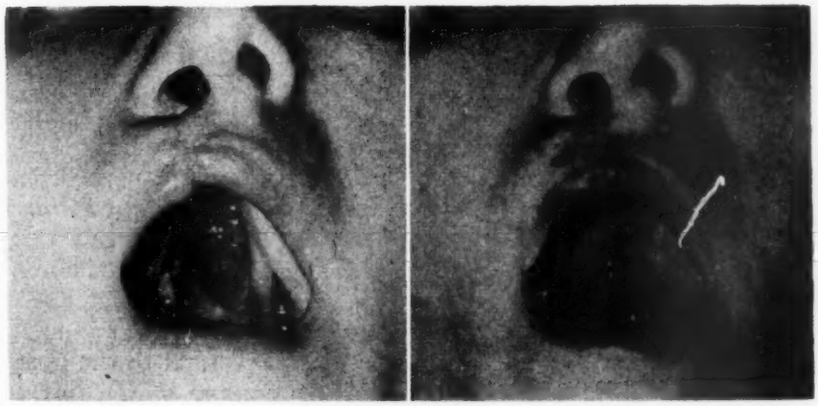

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FIG. 7. Case IV. Twenty-four year old man who had a harelip and palatal repair at eighteen months, followed by breakdown of the palate. The patient had an extensive bilateral palatal defect with the vomer lying very high. His speech was understood only with great difficulty.

FIG. 8. Case IV. One and a half years after reconstruction of palate by V-Y advancement of mucoperiosteal flaps and lining of nasal side with posterior pharyngeal flap, 6.5 cm. long and 3½ cm. wide. Speech has markedly improved even though patient has failed to follow through with speech therapy.

escape and the patient has developed perfectly normal speech. Her personality has become cheerful and exuberant, and she has been given advancements in her position and salary.

CASE IV. H. R., a twenty-four year old man (Fig. 7), had had a harelip and palatal repair at the age of eighteen months, followed with breakdown of the palatal repair. He then had an extensive bilateral palatal defect with a vomer lying so high that vomerine flaps could not be used in the repair. The defect was closed by elevating a large posterior pharyngeal flap (6.2 cm. long and 3.5 cm. wide). The defect of the posterior pharyngeal wall was closed with mattress sutures. Mucoperiosteal flaps

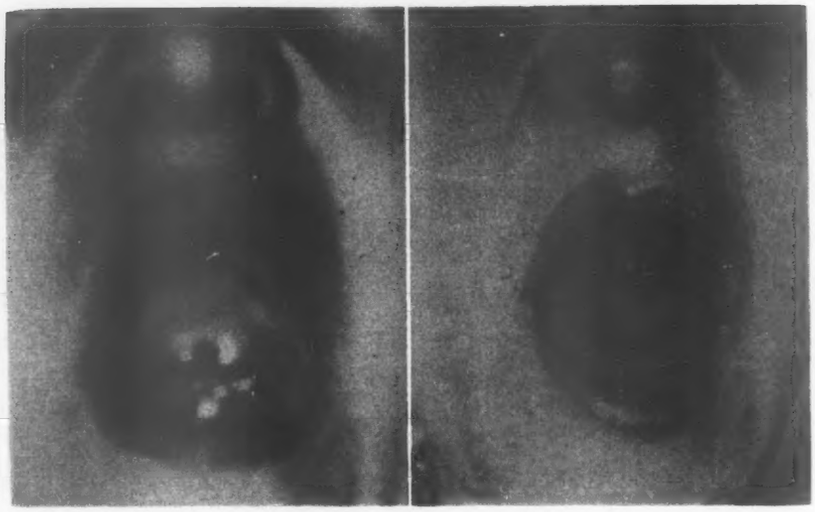

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FIG. 9. Case v. Forty year old woman who was fitted with an obturator at the age of twenty for incompetency of the velopharyngeal sphincter due to submucous cleft of the palate. Teeth deteriorated despite excellent dental care and had to be removed. New plate with obturator was unsatisfactory and finally broke. Speech was very poor and there was marked nasal escape.

FIG. 10. Case v. Note retropositioning of palate following repair. Nasal escape is now corrected, and according to the patient's family and friends, her speech is now more perfect than it was when she wore the obturator.

were then elevated, using the V-Y type of advancement. The flap was anchored with mattress sutures. The repair was completed except for a small opening in the anterior portion of the hard palate which was closed later with a small rotation flap. (Fig. 8.) The patient's speech is markedly improved even though he has failed to follow through with speech therapy.

CASE v. I. M., a forty year old woman (Fig. 9), had been born with a submucous cleft of the soft and hard palate with marked incompetency of the velopharyngeal sphincter. She had been fitted at the age of twenty with an obturator which had improved her speech. Her teeth had gradually deteriorated despite excellent dental care and had to be extracted three years before the present admission. A new plate with obturator was not satisfactory and finally broke. The pharynx was extremely wide and there was marked hypertrophy and thickening of the mucosa with associated scarring from the obturator. The original submucous cleft was still present and there was no interdigitation of the muscles in the midline of the palate. They were separated by a distance of 4 to 5 mm., and as a result there was no effective pull on the soft palate. The uvula was bifid. This defect was repaired by elevating a flap 3 cm. wide and 6 cm. long from the posterior pharynx with the pedicle based cephalad. A hinged flap was raised from the nasal side of the soft palate to elongate it, and the posterior pharyngeal flap was anchored into the defect with interrupted through and through mattress sutures of medium silk; the end of the hinged flap was anchored to the posterior pharyngeal wall at the top of the line of closure of the pharyngeal defect. By doing this all raw areas were completely epithelized. As a result the patient attained perfectly normal speech within one month after surgery was performed. (Fig. 10.) The improvement has been permanent and her friends state that her speech is now much better than it was when she wore the obturator.

COMMENTS

In this series there were sixteen patients in the older age group, from fifteen to thirty years of age, and four patients in the group from thirty-one to forty years of age. Most of this group had had speech therapy with only a moderate amount of benefit because they did not have the mechanism for production of adequate

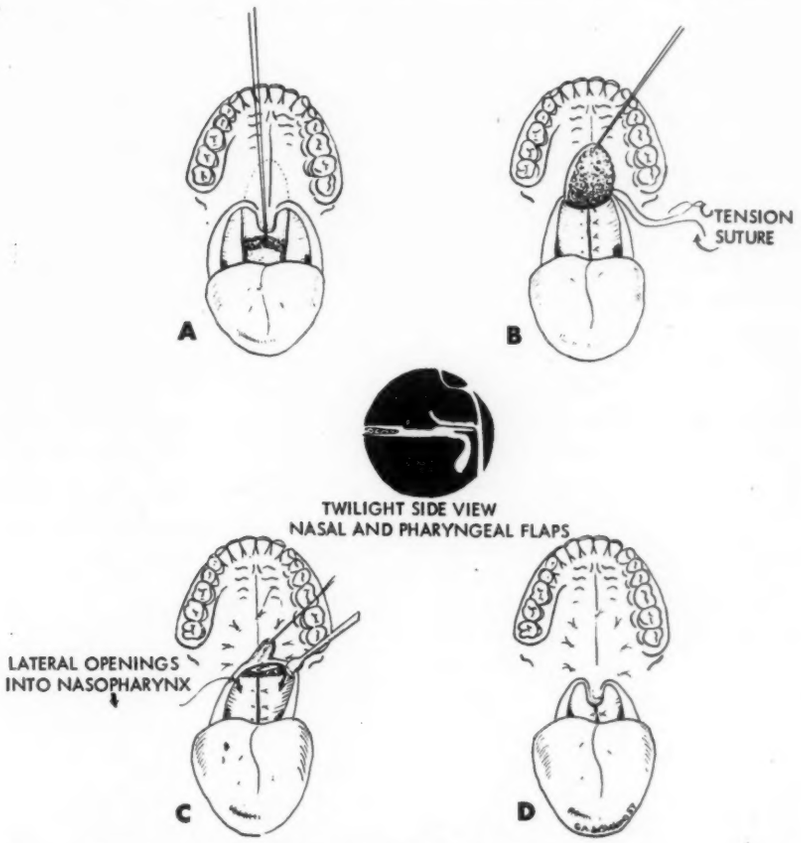

FIG. 11. Diagram of surgical technic: Posterior pharyngeal flap procedure. A, preoperative foreshortened palate with associated wide pharynx; B, posterior pharyngeal flap based cephalad; pharynx narrowed by closure of posterior wall. C, posterior pharyngeal space markedly reduced by anchoring of flaps. D, procedure completed; length of palate increased with diameter of pharynx reduced.

velopharyngeal closure. Once this was provided, their speech improved to the point where only the trained ear could detect residuals of their previous speech pattern. Many of these were corrected by adequate speech therapy. In this group also were patients who had worn a speech bulb for years until their teeth had to be extracted. At this point their entire world appeared to collapse and several contemplated suicide. Following correction of the palatal defect utilizing a posterior pharyngeal flap, they returned to their jobs with renewed energy and a number of them were advanced in position. Their gloomy outlook upon the world disappeared and once again life appeared real and earnest.

As we have observed this group for six and a half years, we have noted that as a group they have been some of our most appreciative patients. In the early part of the series the flap became detached from the palate in two patients. Since then we have had no further breakdowns. Even the two patients in which this occurred showed some improvement in their speech. This undoubtedly was due to the narrowing of the pharynx accomplished by the elevation of the flap and closure of this defect with sutures, plus the bulb-like ridge in Passavant's area produced by the retracted, scarred posterior pharyngeal flap. These combined to diminish the aperture between the oro- and nasopharynx, thereby cutting down the amount of nasal escape.

As we have seen these patients in follow-up, we have noted a gradual change occurring in the old badly scarred cleft palates. They have become increasingly vascular due to the new blood supply obtained from the posterior pharyngeal flap. The firm, "beaver-board like" quality of the scar disappeared and the soft

palate became more pliant and supple. Movement also could be seen in the palates which were previously rigid. In the paralyzed palate group, the tone has improved and movement has also been noted after six months has passed. Our findings are similar to those of Sercer who in 1935 believed that the functional revival was due to regeneration of nerve supply in the atrophic palate. Whether or not neurotization actually occurs is yet to be determined. We do think that the new vascularization obtained through the posterior pharyngeal flap may be a big factor in the improvement noted.

This procedure was undoubtedly abandoned years ago because of the dangers contingent upon opening the prevertebral space and the danger of infection descending into the mediastinum. We have never experienced this in any of our fifty-two patients but have taken the following precautions to prevent it: Postoperatively the patient is kept in shock position (head down) without a pillow for five days. He is given nothing by mouth for the same period and is carried on parenteral fluids. Penicillin and a broad-spectrum antibiotic are also used until the wounds have healed kindly. In most of these patients we have been able to obtain sufficient length of the palate by turning down a hinged flap from the nasal side of the soft palate and anchoring the posterior flap with its pedicle from above into the denuded area. In others we have found it necessary to do a retropositioning of the entire palate, as suggested by Conway. In a few we have had to bring in extraoral tissue because of the size of the defect and the poor quality of the residual scarred palatal tissue. We have purposely made our posterior pharyngeal flaps very wide and have attempted to epithelize all raw areas completely. (Fig. 11.) As a result we have noted only a few cases in which the flap has tubed itself.

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Advantages of a Tracheotomized Anesthesia Technic in the Pharyngeal Flap Operation

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THE administration of anesthesia through a tracheotomy tube as a technical aid in the pharyngeal flap operation was first described in 1953 [1]. At that time thirteen pharyngeal flaps had been done by the staffs of the Nassau Cleft Palate Rehabilitation Center, Hempstead, N. Y., and the Kings County Hospital Cleft Palate Rehabilitation Center, Department of Plastic Surgery, Brooklyn, N. Y. Eight of these were done with the tracheotomy anesthesia technic. (Fig. 1.) This report is a follow-up from these centers, where forty additional cases in which this technic was used, or a total of fifty-three pharyngeal flap operations, have been seen.

The purposes of the pharyngeal flap are: (1) to improve speech, (2) to lengthen a short palate (Fig. 2), (3) to improve the function of a scarred and poorly functioning palate (Figs. 3 and 4), (4) to close openings of previous surgical failures, and (5) to close wide posterior clefts that cannot be successfully closed by other technics.

The administration of anesthesia through a tracheotomy tube facilitates the pharyngeal flap operation and aids in the early accomplishment of these desired results.

Without the use of a tracheotomy for anesthesia the operation must be performed with local anesthesia or with general anesthesia administered through an endotracheal tube. We believe that both these methods have definite disadvantages.

Local anesthesia can be used only in children over twelve or fourteen years of age and in adults. Even in cooperative patients the presence of necessary instruments and the bleeding which occurs cause some degree of respiratory obstruction. This difficulty causes forced breathing, which increases the venous pressure and produces more bleeding. Even the well sedated, cooperative patient becomes appre-

FIG. 1. Tracheotomy anesthesia set-up; ready for palate surgery.

FIG. 2. Typical short palate; one of the indications for a pharyngeal flap.

FIG. 3. Scarred and incompletely closed palate; preoperative view, pharyngeal flap.

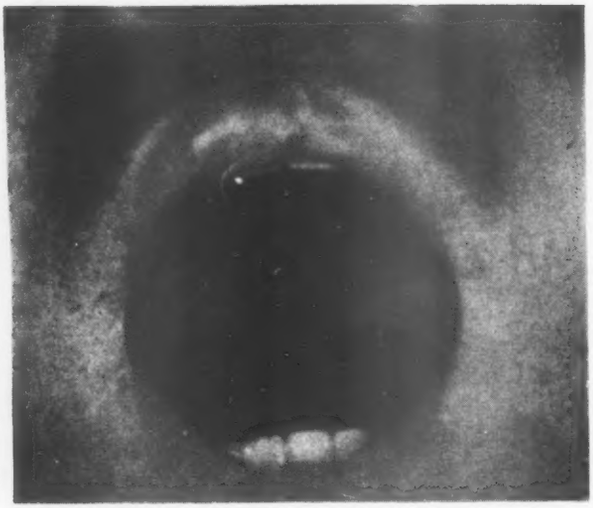

FIG. 4. Same patient as in Figure 3. Postoperative pharyngeal flap; lip repaired and denture inserted.

hensive during this experience. The use of local anesthesia eliminates the younger age groups from consideration for surgery and thus postpones the opportunity for early speech improvement.

The younger patient who cannot cooperate under local anesthesia must be operated upon under general anesthesia. The presence of the space-occupying endotracheal tube in a small pharynx makes the operation quite difficult, and manipulation of the tube while raising the flap can cause postoperative edema with resultant respiratory embarrassment. Surgery therefore is usually postponed until the child is older and has a larger pharyngeal area in which to work.

Based on our experience with fifty-three cases in which the tracheotomy anesthesia technic was used, we believe that this method has definite advantages: (1) The operation can be performed upon young patients with a small pharynx. (2) All anesthetic equipment is removed from the immediate field of surgery, giving the surgeon a less encumbered working area. (3) There is better control of anesthesia during the procedure. (4) The flaps are more easily prepared and bleeding more readily controlled because the field is more accessible. (5) Increased ease in performing the operation leads to a higher percentage of successful results. (6) The time required to perform the procedure is significantly decreased. (7) Postoperative bleeding and edema are not problems because of the protection afforded by the tracheotomy airway.

Care must be taken to choose a tracheotomy tube of the proper size and length, and trained nursing personnel must be available to care for the patient in the postoperative period. Frequent suctioning of the tube and constant observation of the patient must be carried out while the tube is in place.

One might object that a tracheotomy scar is a significant deformity but we have been able to produce fine line scars consistently by performing the tracheotomy in the following manner: A small horizontal incision is made over the trachea 2 fingerbreadths above the sternal notch. This incision need not be over 1 inch in length. After the tube has been placed in the trachea, the ends of the wound are carefully approximated with fine silk sutures. Two silk sutures are then placed through the skin edges in the center of the wound in the region of the tube and are left untied. The tube is removed twenty-four hours postoperatively and these central sutures are tied, thus producing a completely closed wound which heals without deformity.

In doing our series of fifty-three cases, we have standardized our technic for the pharyngeal flap operation. The patient is anesthetized and an endotracheal tube is passed. The neck is extended, prepared and draped, and a low tracheotomy is performed as described. The endotracheal tube is withdrawn as the tracheotomy tube is inserted and the anesthesia is continued through the tracheotomy. The face is then prepared and draped. The patient is placed in the Rose position with the neck ex-

tended and the head in the lap of the surgeon who is seated at the head of the table. The posterior pharyngeal wall is infiltrated with normal saline to separate the musculomembranous tissue of the posterior pharyngeal wall from the prevertebral muscles and fascia and thus facilitate the dissection of the flap. The posterior pharyngeal flap is then dissected from the prevertebral tissue. The flap is based superiorly at the level of the eustachian tube openings. The lateral borders are just medial to the eustachian tube openings, and its length is determined by the amount of tissue needed to bridge the defect present. We prefer to base the flap superiorly so as to increase the length of the flap when necessary, whereas those based below are limited in length. The flap based above allows the soft palate to be pulled upward and backward during speech.

The flaps are usually two-to-one or three-to-one in length, and we have occasionally raised a flap four-to-one in length when using it to close a defect in the palate itself. The posterior palate is then prepared to receive the flap. It is not denuded on one side as is usually described, but rather it is split along its posterior free border, thus creating a pocket in the muscular layer. The distal end of the flap is drawn into this pocket and fixed by three mattress sutures of fine silk, one at each corner of the distal end and the third in the center of the distal end. These sutures are started through the oral side of the palate, passed through the distal end of the flap and back through the oral side of the palate where the ends are tied. Another silk suture is then placed on each side to fix the lateral borders of the flap to the posterolateral margins of the pocket. These sutures are easily inserted, do not embarrass the blood supply of the flap or recipient area and adequately fix the flap in its new position.

At the time of our original report thirteen pharyngeal flap operations had been performed. Three were performed with local anesthesia and two with general anesthesia administered through an endotracheal tube. The average age of these five patients was 18.5 years, and the average time required for surgery was one hour and forty minutes. Eight operations had been performed with the technic described of giving anesthesia through a tracheotomy tube. The average age of these patients was 8.2 years, and the average operating time was one hour and five minutes.

Of these thirteen cases, twelve were successful and one flap sloughed. Speech was improved in eleven of the thirteen cases.

Since the time of the original report, forty additional pharyngeal flap operations have been performed utilizing the tracheotomy anesthesia technic. The average age at the time of surgery in this series was seven years and nine months. Of these forty, twenty-three were patients whom we had followed up from an early age and upon whom we had performed all previous surgical procedures. The average age at the time of the pharyngeal flap operation in this group was six years. In the group which had received initial treatment elsewhere the average age at the time of the procedure was twelve years. It will be noted that among the patients followed up in one center, the decision to perform the operation could be made at a significantly lower age.

In our last forty cases the average time for the entire operation was one hour and eight minutes; for the tracheotomy twenty-one minutes, and for the procedure itself forty-seven minutes. In eight of these cases additional procedures were performed at the same time, such as closure of fistulas, closure of anterior openings in the palate, etc. The average total time of surgery in these cases was one hour and thirty-five minutes, and in the remaining thirty-two cases it was one hour and three minutes.

Of this series of forty pharyngeal flap operations, thirty-seven were successful. One child died four days postoperatively of meningitis, and in one boy two attempts to do the flap failed. This was due to interposed streptococcal throat infections. In another patient who had a successful flap, temporary atelectasis and a mediastinopleural pneumothorax developed. This was thought to be due to a perforation from an overly long tracheotomy tube.

Postoperative evaluation of the patient's speech is the most important criterion for evaluating the success of the procedure. In this series all the patients had poor speech preoperatively. After surgery, three patients had excellent speech, eight had very good speech, twelve had good speech, twelve had fair speech and four remained poor.

We have classified those with excellent, very good and good speech as having socially ac-

ceptable speech. In this series 59 per cent of the patients now have socially acceptable speech.

SUMMARY

1. A tracheotomy anesthesia technic as a technical aid to the pharyngeal flap operation is discussed.

2. Over fifty pharyngeal flap operations are evaluated, and the technic of the flap application is described.

3. The advantages and disadvantages of this technic are reviewed.

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Anesthetic Management for Maxillofacial Procedures in the Very Young

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ANESTHETIC management during repair of congenital defects in the maxillofacial region is difficult when such surgery is contemplated upon the very young. Both pediatrician and surgeon are anxious to correct these deformities as soon as possible. If such correction is made early, there will be better molding of the maxillary segments and simplification of feeding problems. When this deformity is corrected, the infant is more readily accepted by his family and community.

These fragile newborn infants are slightly undernourished, dehydrated and frequently have other defects with attendant complications. These anatomic and physiologic disturbances, coupled with the competition of the anesthetist and surgeon for the same operative area, will demand the most of skill, cooperation and ingenuity.

The basic fundamentals of sound anesthetic practice must be applied to these patients.

1. Adequate oxygenation and elimination of carbon dioxide must be maintained at all times; this means all measures necessary to insure proper ventilation through an unobstructed airway. It is only in this manner that hypoxia can be avoided and respiratory acidosis prevented.

2. Proper depth of anesthesia and analgesia is necessary to prevent movement of the infant. It is also essential to provide muscular relaxation so that surgical apposition of the structures can be maintained without undue tension on suture lines.

3. Provision must be made for adequate fluid replacement and electrolyte balance. Phlebotomy prior to surgery is indicated when significant blood loss or a prolonged procedure is expected [2]. The blood volume of an infant is approximately 100 cc. per kg., while that of an adult is 90 cc. per kg. An infant weighing 5 kg. loses about 24 per cent of his blood volume by losing only 120 cc. of blood, whereas an adult weighing 70 kg. must lose 1,500 cc. of blood to reduce his blood volume an equal amount [1].

4. Constant observation of the more readily accessible homeostatic mechanisms, such as body temperature, pulse rate and respiratory exchange, must be maintained.

The technic embodying these principles is based on a case experience of 1,320 anesthetics administered to a group of 430 patients ranging in age from two weeks to eighteen months. All required correction of either congenital, acquired or traumatic deformities of the maxillofacial region.

PREPARATION OF PATIENT

These infants are thoroughly examined by the pediatrician to ascertain the presence of any other congenital anomaly, especially of the heart, trachea and great vessels. It is not unusual for such associated conditions to exist, and their presence may influence both the surgical approach and the anesthetic management. (Fig. 1.) The pediatrician and the surgeon determine the optimum time for surgery.

PREPARATION OF PATIENT IMMEDIATELY PRIOR TO SURGERY

Infants two weeks to four months of age are permitted a feeding of one-half the quantity of the usual formula or fluids up to four hours before surgery. We have never encountered any vomiting as a result of this and we believe that a more adequate fluid and electrolyte balance can be achieved in this manner. Preanesthetic medication is omitted in this age group. These patients have a low metabolic rate and should not be further depressed with

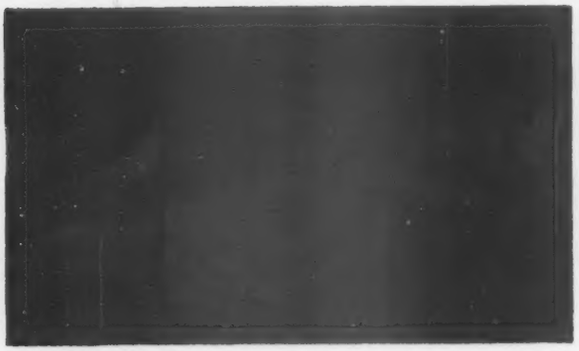

FIG. 1A. Infant born with unilateral cleft lip and wide cleft palate, atresia of the nasolacrimal ducts and absence of fingers and toes.

FIG. 1B. Tip of nasolacrimal probe seen at roof of mouth, demonstrating severe cleft palate.

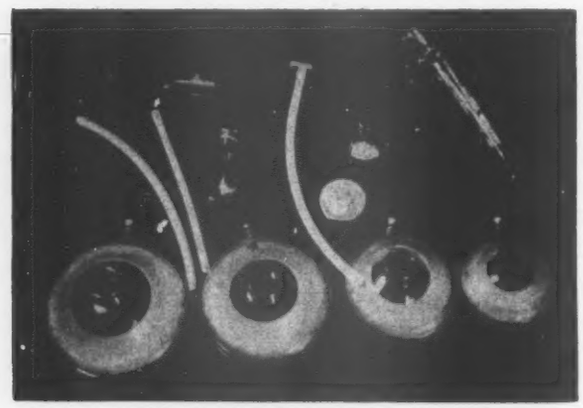

FIG. 2. Small masks, Turnbull connectors, endotracheal tubes and laryngoscope specially designed for these infants. The relative size can be judged by comparing with the 25 cent piece.

opiates or barbiturates. Atropine and scopolamine are also omitted since secretions have seldom been a technical factor.

Infants from four to eighteen months of age usually sleep through the night. If they awaken and it is necessary to feed them, they are given a 4 ounce formula up to six hours prior to surgery. Premedication in this age group depends on the physical and mental activity of the patient. Here, information furnished by the nurses is of extreme value. Seven to 15 gr. chloral hydrate given as a small retention enema, and 1/600 gr. of scopolamine administered subcutaneously forty-five minutes before surgery will often produce hypnosis without undue depression.

Our objective during anesthesia is to achieve an adequate degree of analgesia with a controllable hypnotic state. To accomplish this it was necessary to develop suitable equipment. The customary open drop ether mask of the Yankhauer type, with its calculated dead air space of about 250 cc., has been replaced by a much smaller one. This smaller mask has an inlet vent in the rim about the wire mesh so that oxygen or any combination of gaseous anesthetic agents can flow into the mask about the patient's nose and mouth. This free flow of anesthetic gases and oxygen also aids in the elimination of carbon dioxide. (Fig. 2.)

All patients are intubated using a small Portex catheter fitted with either a Turnbull or Ayres adapter. These adapters permit the use of an open endotracheal system. We think that for these small infants an open endotracheal system is the most physiologic and the one best suited for this surgical procedure. This method reduces to a minimum the resistance to breathing. No valves or rebreathing bags are interposed in the mechanical set-up. The only resistance to breathing is the endotracheal tube. Since we use a small tube, there is usually a space between the vocal cords and the endotracheal catheter which allows some exhaled gas to escape around the tube into the hypopharynx and mouth. A light gauze packing around the catheter absorbs any secretions or blood that appears but does not prevent the escape of the excess anesthetic gases. This packing is identified with a heavy silk thread which projects out of the mouth near the endotracheal catheter. The use of the endotracheal tube and the open endotracheal system has stopped the custom of the anesthetist donning gown and gloves and continuing the anesthetic in such a manner. It is no longer necessary to place a suture through the tongue in order to maintain an airway or furnish retraction. The airway is amply secured by the endotracheal catheter which may project either from the side

FIG. 3. Oral endotracheal catheter with a Turnbull connector.

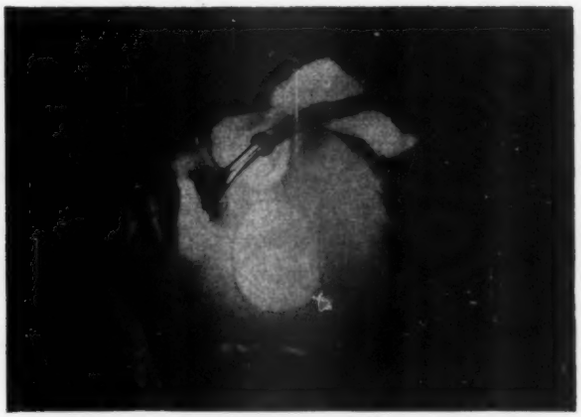

FIG. 4. Nasotracheal tube with Ayres adapter.

of the mouth or from the nose. (Figs. 3 and 4.) The anesthetic can then be managed out of the operative area. This has the added advantage of removing bulky and cumbersome anesthetic equipment from the operative site.

Respiratory assistance or resuscitation can be achieved by increasing the flow of oxygen and placing the fingers over the apertures to occlude them rhythmically. We have modified the Turnbull connector by increasing the curvature so that it fits snugly over the angle of the mouth, thus eliminating the securing of the tube with adhesive tape.

We are aware that endotracheal catheters and laryngoscopy can cause trauma to the delicate structures of these infants. This can be overcome or minimized by observing gentleness in the handling of all tissues. In this group of 430 patients no complications have occurred that can be attributed to the intubation of the larynx or the use of the endotracheal tube.

ANESTHETIC AGENTS

Open drop vinethene® or cyclopropane flowing through the small mask is used for induction. If for any reason we have difficulty with the patient, we do not hesitate to terminate the procedure and cancel the surgery. In three cases in this group it was necessary to cancel the surgery because of difficulty during induction. In each instance satisfactory anesthesia was obtained without difficulty about a week later and the surgery was completed.

Anesthesia is maintained with a mixture of nitrous oxide, oxygen and small increments of ether vapor. The absolute control of the airway by the endotracheal catheter has enabled us to manipulate our anesthetic agents so that in actuality we are producing not an anesthetic state but rather an analgesic plane with some degree of hypnosis. This is adequate to keep these infants quiet, to have the mouth open and the tongue retracted, and to produce the degree of muscular relaxation that the surgeon needs for the dissection. It also gives the surgeon a quiet field in which to work. He does not have to hurry because of recurrent bouts of obstruction and anoxia with a struggling, gagging patient. With this controllable hypnotic state the patients are awake within thirty to ninety seconds after the termination of the actual administration of the nitrous oxide, oxygen and ether mixture.

We employ various monitoring devices to keep us constantly informed of the patient's condition. The precordial stethoscope serves a dual purpose. With it one can instantly check any variation in the heart rate. Any change in the character of the respiratory pattern may indicate either an alteration in the analgesic and anesthetic plane, a partially obstructed or kinked endotracheal tube, or the possibility that the endotracheal catheter is lodged in one of the main bronchi producing a slow but progressive atelectatic condition on the opposite side. Any one of these complications can be quickly remedied without disturbing the surgeon.

The temperature is constantly checked. Not infrequently these infants will begin to have an elevated temperature about half an hour after surgery has started. We attribute this to the heavy surgical draping and inadequate ventilation under the drapes as well as to heat from the operating room lights. At the present time

the surgical draping is minimal and we have not noticed any elevation in temperature.

The advantage of the technic described heretofore is that we have absolute control of the patient at all times. The endotracheal catheter insures the airway and the means of maintaining satisfactory anesthesia. Ayres and Turnbull connectors permit the use of an open endotracheal system which these infants tolerate very well. The anesthetist conducts the anesthesia at a point remote from the surgical field. The comfort and the security attained by the use of the endotracheal catheter in these infants is worth the effort of learning the method of its application.

CONCLUSIONS

1. The anesthetic technic for use in maxillofacial procedures, employed in a group of 430 infants ranging in age from two weeks to eighteen months, has been described.

2. The use of the endotracheal catheter and an open endotracheal system has many advantages for these infants. The anesthetic agents nitrous oxide, oxygen and ether are used to produce a controllable hypnotic and analgesic state.

3. There have been no complications attributed to the use of the endotracheal catheter in this group of patients.

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Nasal Splints

ADVANTAGES, DISADVANTAGES AND AUTHOR'S MODIFICATIONS

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NASAL splints may be divided into two groups, internal and external. Each is designed and used for a specific purpose. A considerable overlapping in function is found in both groups.

It is hardly necessary to mention the shortcomings of the various nasal splints in use today. While they serve a good purpose, there is much room for improvement. (Figs. 1 and 2.)

The almost ideal splint for rhinoplasties was designed about four years ago by the author. This splint is made up of 30 G. Brown and Sharp tin. Fortunately, all ether, tomato, prestone cans and other cans of similar nature are made of the same gauge metal, so the source of supply is adequate and easily obtainable. The splint is designed first from a basic form. (Fig. 3.)

Three or more different sizes are made out of cardboard and used as templates. The one side is covered with waterproof adhesive and the other side with flesh-colored adhesive.

On completion of the operation, a vaseline gauze dressing is placed in each nostril and, if so desired, a rubber tube may also be inserted for breathing at this time. The character and size of the nose and type of operative procedure will determine the advisability of a rubber tube.

The assistant holds lateral pressure on the nose with a sponge while the splint is trimmed and bent to conform to the new nose in all dimensions. The waterproof side of the adhesive is placed against the skin and the flesh-colored side out. The handle of the long Metzenbaum scissors is a good instrument with which to start the bending of the splint. This should be done accurately to support the nose firmly in its correct position and shape. The distance from the base of the ala to the tip of the nose should be measured and transferred to the splint to get its proper height.

Placing the splint between the handles of the

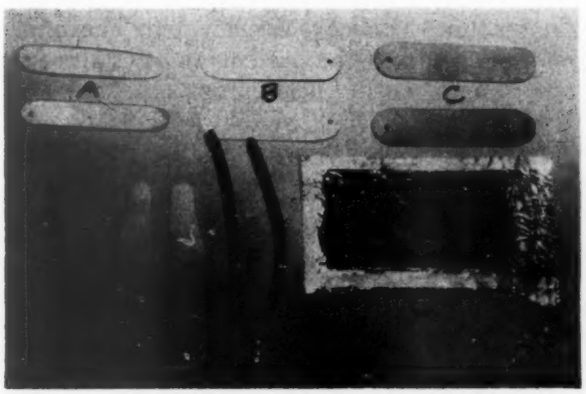

FIG. 1. Internal splints composed of: (A) celluloid, (B) gutta percha, (C) wooden tongue blade cut short, (D) perforated hard hollow rubber tube, (E), paper maché absorbing, (F) rubber tubing, (G) vaseline gauze.

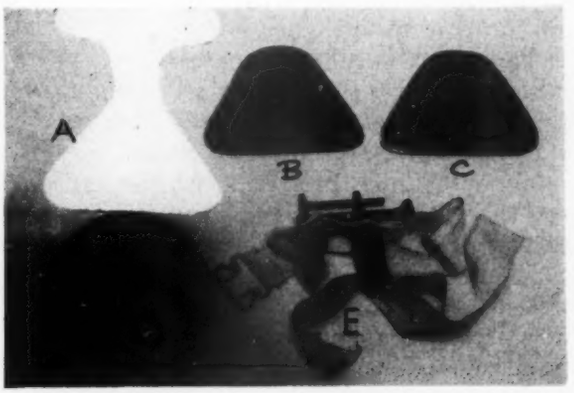

FIG. 2. External splints composed of: (A) sheet tin plate, (B) tantalum, (C) sheet lead, (D) modeling compound, (E) external Joseph nasal splint and modifications.

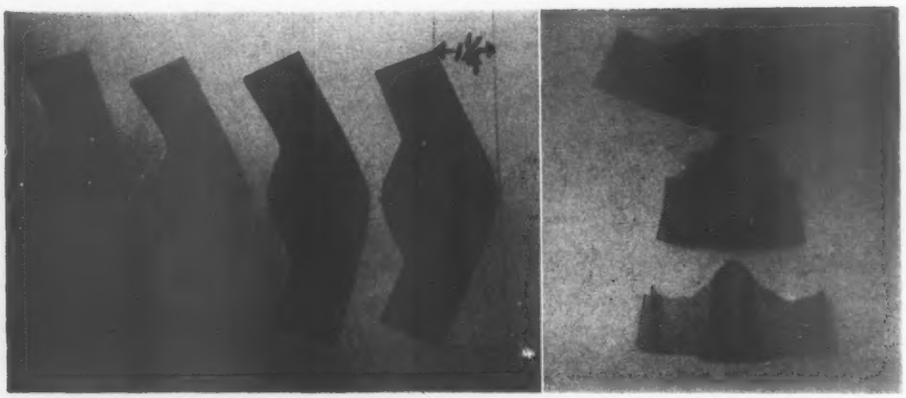

FIG. 3. Author's splint, made of 30 G. Brown and Sharp tin, 40 G. Brown and Sharp aluminum and adhesive tape.

FIG. 4.

long Metzenbaum scissors gives one a chance to bend and attain the angles at the precise point. The upper edge of the splint should be rounded upward so it will not cut into the glabellar tissue. The rest of the splint may be contoured easily by digital pressure. The ends of the splint should be about as high as the bridge of the nose. This gives a good opportunity to drape the adhesive over this edge and draw it down slightly.

The splint is adjusted carefully to fit the nose accurately. Then the splint is placed over the nose and with the Metzenbaum scissors closed, the nose is literally wiped into the splint by holding the splint with the left hand and then passing the scissors between the splint and the nose in an upward fashion from the ala to the tip of the nose. The nose now should be well up and seated in the splint. The assistant now holds the splint in place with two fingers from below. The piece of adhesive that holds the splint is flesh-colored and is folded in the center to get the central point so that when it is placed on the splint it is equal on each end. While the assistant is holding the splint, the adhesive is now draped over the edge, the left cheek is slightly raised, and the adhesive is set on the cheek on that side. The same procedure of slightly raising the cheek and setting the adhesive is followed on the right side. A second piece of adhesive is now placed on the dorsum of the splint and is attached to the forehead. The degree of clamping action and downward pressure of this splint is controlled entirely by the amount the cheeks are elevated. This offers no discomfort to the patient and permits free movement of the head from side to side. (Fig. 4.)

A gauze dressing, as a rule, is not placed between the splint and the nose.

The advantages of the author's splint are: (1) All the parts of the nose are supported in their normal position with equal pressures. (2) The splint prevents swelling, hemorrhage and hematomas. (3) It corrects deflections to the right or left while healing. (4) It gives good visible support to the tip and the base of the nose. (5) It may be adjusted to any position at any time. (6) Splints may be fitted to each individual patient. (7) The splint is light and

comfortable. (8) It allows free motion of the head in any direction. (9) The same tension is constant every minute of the day and night. (10) The splint may be removed easily every day by merely cutting the adhesive between the cheek and the splint and reflecting the splint upon the forehead. (11) The patient cannot tamper with the adjustment of the splint. (12) The skin of the entire nose may be examined daily. (13) Lateral and vertical pressures may be controlled to any degree and held as long as desired. (14) Damage to the skin of the nose is prevented by the lower edge of the splint coming to the lower edge of the nose. (15) The splint does not interfere with sight. (16) The splint is easily molded or fitted to the patient. (17) There is minimal adhesive tape on the skin. When changed, the adhesive is placed on top of the old adhesive. (18) The splint need be worn for only about two weeks. (19) This splint will also control most cases of epistaxis.

The Management of Tuberculous Cervical Adenitis

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THERE has been a great variation of opinion concerning the optimum treatment of tuberculous lymphadenitis. This is in marked contrast to the employment of specific antimicrobial agents and surgery in the treatment of pulmonary and certain types of extrapulmonary tuberculosis. Both the surgical and radiation forms of treatment of tuberculosis of the cervical lymph nodes have had their advocates. However, the scarcity of information about the merits of these treatments in the light of the newer antimicrobial agents has led to a request for such studies from the Committee on Therapy of the American Trudeau Society as recently as November, 1954. This article represents an effort to document the findings from the treatment of a series of patients with solitary tuberculous cervical adenitis seen at the Presbyterian Hospital in New York from 1954 to 1956, inclusive.

In the young child, tuberculous cervical adenitis generally has been due to the bovine bacillus in infected milk as a primary regional disease, with the oropharynx as chief portal of entry. In the older patient, however, there is evidence from the studies of Park and Krumwiede [1] that the human type of tubercle bacillus may predominate. Lester [2] has stated that cervical tuberculous lymphadenitis is always of the human type with a predilection for the neck as a hematogenous infection due to lowered tissue resistance from previous infections.

In 1948 Hamilton Bailey [3] described four stages in the pathogenesis of this disease: (1) pus is limited to the fibrous envelope of the nodes; (2) the nodes rupture and the pus spreads to the spaces of the deep cervical fascia; (3) from the second stage the products of inflammation pass into the superficial cervical fascia as a collar-button type of abscess, and lastly (4) into sinus formations.

The diagnosis of tuberculous cervical adenitis can usually be made from (a) the presence of unilateral, matted, non-tender lymph nodes of more than six weeks' duration at the angle of the mandible, or in the lateral cervical triangle of young persons; (b) a positive tuberculin test (a negative response to a dilution of 1:100 can rule out tuberculosis); (c) history of contact with tuberculosis or the ingestion of raw milk; (d) culture and biopsy; (e) x-ray evidence of calcifications in the neck (Hanford's sign) [4].

In the differential diagnosis, appropriate clinical and laboratory procedures exclude such entities as non-specific cervical adenitis, malignancies, syphilis, actinomycoses, Hodgkin's disease, branchial cysts, infectious mononucleosis and leukemia.

Balkhausen [5] has outlined the history of treatment of lymphoglandular tuberculosis over the past fifty years. At first excisional surgery was the method of choice. Then followed conservative measures such as heliotherapy, radiation, etc. A controversial phase of tonsillectomy and adenoidectomy either preceded or followed by a simple glandular neck dissection also appeared. In 1952 Oppikofer [6] found twenty-five positive tonsils in fifty-one cases reported from his studies in Switzerland. However, further documentation of this result has been quite variable.

Lester [2] also has emphasized the surgical treatment, but advised that this be performed on the "good chronic" patient when there is no activity of tuberculosis elsewhere in the body. The surgical technics consist of sharp dissection and excision of the enlarged matted masses. All the vital structures including the

spinal accessory nerve are preserved in contrast to the technics of the radical neck dissection.

As regards antimicrobial therapy, streptomycin, PAS (para-aminosalicylic acid) and isoniazid (isonicotinic acid hydrazide) alone or in combination, have been the agents used in this study. In general, the dosage of these drugs has been 1.0 gm. streptomycin twice weekly, 10 to 12 gm. PAS daily and 300 mg. isoniazid daily.

TABLE 1
RESULTS OF DRUG THERAPY IN TUBERCULOUS CERVICAL ADENITIS

Drug	No. of Patients	Cures	Recurrences
Streptomycin	3	0	3(*a*,*b*,*c*)
Streptomycin + PAS*	4	0	2(*d*,*e*) 2 (smaller, persistent masses)
Streptomycin + INH†	1	1	.....
INH	1	1	.....
INH + PAS	9	8(*b*,*e*)	1(*c*)
INH + PAS + Streptomycin	3	3(*d*,*f*)	.....

NOTE: (*a*) Streptomycin for 3 mo., repeated fluctuant abscesses; radiotherapy 1,600 r with persistent abscesses 1 yr.; surgical dissection with cure (15 mo. follow-up).

(*b*) Streptomycin for 2 mo., persistent discharge; INH + PAS for 6 mo. with cure (27 mo. follow-up).

(*c*) Streptomycin for 8 mo., multiple abscesses; INH + PAS for 6 mo., persistent abscesses; radiotherapy 1,000 r over 10 wk. with cure (16 mo. follow-up).

(*d*) Streptomycin + PAS for 2 mo., recurrent abscesses; INH + streptomycin for 10 mo. with cure (15 mo. follow-up).

(*e*) Streptomycin + PAS for 3 mo., abscesses; streptomycin + INH for 1 mo., then surgical dissection; INH + PAS for 9 mo. postoperatively with cure, (12 mo. follow-up).

(*f*) 17 yr. persistent sinuses; complete remission after 6 mo. INH + PAS + streptomycin.

* Para-aminosalicylic acid.

† Isonicotinic acid hydrazides.

Twenty patients were studied. There were five male patients and 15 female patients. The diagnosis was documented in all cases by positive culture or tissue examinations. No evidence of pulmonary tuberculosis by clinical or x-ray studies was present. The results are illustrated in Table 1. It is evident that streptomycin was ineffective except where employed in combination with isoniazid. Radiotherapy was effective in preventing recurrence, although firm, small nodes persisted in two of three patients in this study who had persistent abscesses despite combinations of brief therapy with isoniazid and streptomycin and PAS. Isoniazid employed in various combinations was successful in thirteen of fourteen patients.

Mental disorders were not noted in this group of patients. One patient had peripheral neuritis which responded following withdrawal of the drug. Zitrin and Thompson [7] have reported substantially the same absence of psychoses in twenty patients who received isonicotinic acid hydrazides for more than six months. These writers noted mild toxic effects such as muscular twitchings and peripheral neuritis. Pyridoxine has been recommended for the relief of the peripheral neuritis when it appears.

SUMMARY

1. Twenty patients with documented cervical tuberculous adenitis without evidence of pulmonary tuberculosis have been studied.

2. Of the various forms of surgical and antimicrobial therapy, isoniazid in combination with para-aminosalicylic acid or streptomycin was successful in thirteen of fourteen patients (89 per cent).

3. In this study only three patients received radiation therapy. In two of these patients the disease was restrained to small, firm masses despite antimicrobial failure.

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Laryngocele

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THE laryngocele, also termed the ventriculocele and ventricular laryngocele, is a hernia of the larynx. Anatomically, a small space exists between the true and false cords known as the ventricle of the larynx. Normally there is a small diverticulum, known as the appendix of the laryngeal ventricle, which extends upward between the ventricular fold and the inner surface of the thyroid cartilage.

Galen [*1,2*] first mentioned the laryngeal ventricle in 300 A.D. Morgagni [*2,3*], for whom it is named, gave an incomplete description of it in 1741. He also gave credit to Galen for first recognizing the ventricle. MacKenzie [*4*] suggested calling it the ventricle of Galen. In 1829 Larrey [*5*] made note of cystic, air-filled tumors of the neck of blind men employed to make the calls to prayer from the temple towers of Egypt, and to their presence he ascribed the progressive voice impairment which eventually reduced the men to labor on the temple grounds and fish ponds. In 1865 Bennett [*6*] discovered the first air sac demonstrable in man in an abnormal larynx not known to have been present during life. In 1867 Virchow [*7*] reported unusual degrees of dilatation of the ventricle of the larynx and designated them laryngoceles. Probably a better term is ventriculocele, since it is a direct hernia of the ventricle.

ANATOMIC CONSIDERATIONS

Gross Anatomy. The normal ventricle is an elliptical recess horizontally placed between the true vocal cord and the ventricular band or false vocal cord. Its size varies markedly, which makes it difficult to establish a normal base line of anatomical proportions. It is entered by a narrow, slit-like aperture just superior to the true cord. Limiting it above is the ventricular band or false cord, and the boundaries laterally and below are the membranous portion of the true vocal cord and the various fasciculi of the thyroarytenoid muscle. A tiny orifice is found anteriorly in its wall, and extending above is an elongated diverticulum or sacculus which rises vertically to occupy a pocket between the thyroid cartilage and the base of the epiglottis. The sacculus, also known as the appendix of the ventricle, is a constant anatomical finding in the human being, varying in size from a simple pit or depression near the anterior end of the ventricle to a narrow prolongation extending up to the upper level of the thyroid cartilage or, in rare cases, even higher. This structure is well developed in fetal life and infancy but later lags behind the ventricle in growth. Lattice-like fibers of the thyroarytenoid muscle contribute to the lateral and medial support. It is from the extension of this sacculus or appendix of the ventricle that laryngoceles are formed. An abnormally long appendix extending beyond where it can be supported by the sphincter action of the thyroarytenoid muscle might predispose toward the development of an air hernia or laryngocele.

Microscopic Anatomy. The ventricle of the larynx and saccule is composed of ciliated, pseudostratified, columnar epithelium with a fragile basement membrane. The walls are formed from fibrous tissue which supports minute blood vessels and mixed mucous glands. Goblet cells are variable in number. Contraction of the thyroarytenoid muscle during speech or swallowing increases the output of secretion which is necessary for lubrication of the vocal cords.

Developmental and Comparative Anatomy. Frazer [*8*] has identified the ventricle and saccule as definite active outgrowths from the

larynx set apart from all the visceral clefts and placed immediately above the nodules which became the true vocal cords in the eighth week of embryonic life. According to Galatti [9] and more recent authorities, the sacculus normally loses its capacity for further growth by the sixth year, while the ventricle acquires a deeper cavity and then enlarges slowly until it attains the adult proportions about two years later. The saccule is an atavistic anatomical structure, similar to but smaller in size than the air sac seen in anthropoid apes, which can extend from the neck down to the pectoral muscles [10]. Below the level of the inlet of the larynx within the confines of the wedge-shaped thyroid cartilage, the laryngeal sphincter girdle appears, either as a single tier (ox, lion, cat, lemur, deer, sheep, goat) or, in the instance of man and other animals (dog, ape, monkey, bear, pig), as a two-level tier, each separated from the other by an inpocketing in the substance of the thyroarytenoid muscle forming the ventricle of the larynx [11]. Noting this anatomical difference, it is apparent that ventriculoceles cannot form in animals with a single tier. Freedman [12] considers that the ventricular pouches act as mixing chambers during periods of fixation of the glottis. During this period, stored oxygen may be utilized for continuation of activity without respiration.

ETIOLOGY

Extension of the saccule to the soft tissues of the neck may be promoted by a weakness, or even deficiency, of the thyrohyoid membrane where it is perforated by the superior laryngeal nerve and vessels. Increase in intraglottic pressure from such causes as acute coughing, especially whooping cough, chronic coughing, singing, horn blowing, glass blowing, weight lifting, vomiting, straining at stool and childbirth may contribute to the formation of the hernia. Other diseases such as tumors, syphilis and tuberculosis may be contributing factors. Edema of the orifice of the ventricle is an important factor since it obstructs drainage. A congenitally long saccule or merely aging of the tissues with loss of normal tissue strength may also be factors. Once such enlargement starts, it can grow by virtue of a ball-valve type of action. By thus enlarging, it makes itself known by signs and symptoms upon the glottis or eventually in the soft tissues of the neck.

CLASSIFICATIONS

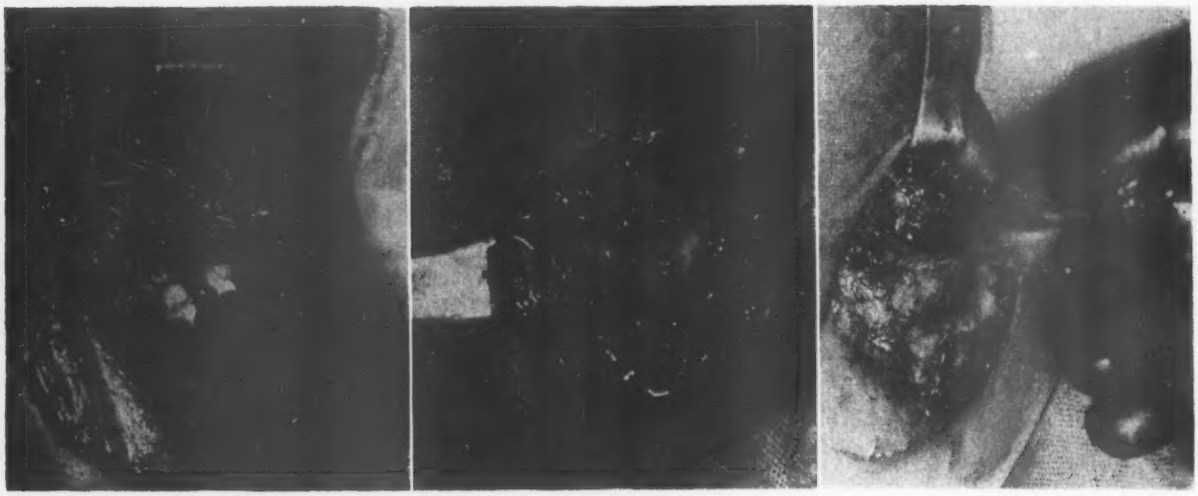
Laryngoceles may be classified according to their position or content. Positional classification would include: (1) internal, in which there is encroachment upon the glottic chink and sometimes extending to the aryepiglottic fold, or even to the base of the tongue, remaining at all times internal to the thyrohyoid membrane; (2) external in which the herniation extends through the thyrohyoid membrane into the soft tissues of the neck; and (3) the combined variety, in which there is a tendency to extend in both directions. They may be further classified according to content: air (laryngocele), mucus (laryngomucocele) or pus (laryngopyocele).

DIAGNOSIS

Diagnosis is based upon certain signs and symptoms and *a knowledge that the condition may exist*. Impairment of the voice with hoarseness is usually the first symptom. Chronic cough and dyspnea may become prominent as the size of the mass increases. The dyspnea may become severe with noisy respirations and obstruction producing asphyxia in later stages. A belching sound before speaking may occur due to expulsion of air by voluntary contraction of the pharyngeal constrictors. Occasionally dysphagia may occur, usually due to inflammation of the sac. The prominent physical finding is an enlarging cervical mass which can at times be emptied by pressure, and the sound of escaping air, or air and fluid if infection is present, may be heard. A laryngocele must be considered in the differential diagnosis of masses of the anterior triangle of the neck. On indirect as well as direct laryngoscopy a thickening of the ventricular band may be seen. Roentgenography, particularly laminagraphy, is important in the diagnosis, since the air- or fluid-filled cavity may be seen. When lipiodol is injected into the sac under fluoroscopy, it can be seen to escape from the ventricle; but this procedure is not usually warranted. The possibility first of asphyxia and second of infection in the sac requires that these space-occupying entities be diagnosed and surgically removed.

COMPLICATIONS

Infection usually involves a laryngocele sooner or later. The onset of this may occur



1A 1B 1C

FIG. 1. Surgical technic. A, hernial sac and relation to superior laryngeal nerve and vessels. B, superior cornu of thyroid cartilage isolated to allow access to neck of sac. C, base of neck of hernial sac delivered from the laryngeal ventricle.

during acute laryngitis or pharyngitis. This may be the transitional change from a laryngocele to a laryngopyocele. When this transition occurs, dysphagia is a prominent symptom. When a pyocele has developed, the condition is obviously more serious; and there will be rapid impingement of the sac into the glottis leading to a febrile course and asphyxia. In 1915 Shambaugh [13] described the case of a sixty-nine year old white woman whose laryngocele discharged large quantities of purulent secretion day and night, constantly waking her up. She was able to obtain partial relief by pressure over the external sac, evacuating as much as a quarter of a tumbler of pus at one time. There are cases in the literature in which an association with carcinoma exists, but no cause and effect relationship has been demonstrated. It is possible that the irritation produced by a laryngocele on the cord might initiate the formation of a neoplasm. As previously stated, dyspnea and impairment of the voice may occur. Rupture of the pyocele externally may result in a lateral pharyngeal space infection.

SURGICAL TECHNIC

A transverse incision in a flexion crease was made over the central portion of the presenting mass in the lateral side of the neck. In each case the incision extended from the anterior border of the sternocleidomastoid muscle to the midline of the neck. The incision was made through the platysma and superficial layer of the deep cervical fascia to the wall of the hernial sac. The carotid sheath was retracted posterolaterally. The sac was isolated by sharp and blunt dissection. (Fig. 1.) As the neck of the sac was approached, it was necessary to sever partially the inferior constrictor muscle from the oblique line of the thyroid cartilage. The thyrohyoid membrane and muscle were freed from the superior border of the body and superior cornu of the thyroid cartilage. This cartilage was retracted medially and the hernial sac with its neck was delivered laterally beneath the superior cornu of the thyroid cartilage to facilitate the dissection to the base of the neck, at which point one is at the ventricle of the larynx. The neck of the laryngocele was then ligated, cut and transfixed. The incision was closed in the usual fashion. It is best to make the incision in the skin and subcutaneous tissues in separate planes and also to effect closure in separate planes. In our experience, this helps to prevent a binding down and contracture of the skin to the thyroid cartilage.

CASE REPORTS

CASE 1. A thirty-nine year old Negro housewife complained of a progressing enlargement of a mass in the right side of the neck for about three years. She distinctly dated the onset of her condition to a hacking cough followed by awareness of a small mass of fingertip size. Subsequently acute pharyngitis developed and the mass increased in size. In the interim she had had two acute attacks of pronounced swelling of the mass with difficulty in talking

FIG. 2. Case I. Planogram, preoperative view. View shows right ventriculocele.

FIG. 3. Case II. Planogram, preoperative view. View shows right ventriculocele.

and breathing. Singing had caused the mass to become painful and increase in size.

On examination externally there was a soft tissue mass in the anterior triangle approximately 5 by 5 cm. in diameter, which had the consistency of a lipoma. Examination of the glottis revealed a smooth mass involving and displacing the right ventricular band. The diagnosis of laryngocele was further confirmed by planography. (Fig. 2.) Surgery was done using the technic described. The pathological diagnosis was a cyst consistent with laryngocele and which showed marked inflammatory infiltration. Postoperatively the patient was relieved of her symptoms with regard to both the glottis and neck.

CASE II. A sixty-eight year old white man entered the clinic with the complaint of having something caught in his throat together with difficulty in swallowing for the past two years. The condition had become progressively more severe. Hoarseness had likewise become a prominent and important factor.

Examination of the neck revealed a small, cyst-like mass 3 by 4 cm. in diameter in the right thyrohyoid area. Intralaryngeal examination showed fullness of the right ventricular band with some loss of the normal size of the glottic chink. The possibility of laryngocele was entertained and proved after planography had been obtained. (Fig. 3.)

Surgery was performed using the technic described. The pathological diagnosis was a membranous structure lined by ciliated respiratory epithelium and having a well vascularized fibrous stroma which showed chronic inflammation and minute abscess formation.

The entire postoperative course was uneventful. The patient's symptoms of dysphagia, dyspnea and hoarseness were completely obviated.

SUMMARY AND CONCLUSION

Two cases of laryngocele in our clinic stimulated a search through the literature of the past twenty years for other cases of this most interesting lesion. Approximately 120 cases have been reported during this period. Although the condition is uncommon, it is probably more frequent than is generally suspected.

The anatomy, physiology, classification and methods of diagnosis are discussed.

The main purpose of the ventricle and saccule of the larynx is to contribute to the lubrication of the vocal cords.

Complications such as infection and asphyxia increase the importance of recognizing this lesion. Also, the laryngocele should be kept in mind in differential diagnosis because it may help to explain some of the symptoms of dyspnea, impairment of the voice, and signs of swelling and masses in the neck when no other lesion is found.

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Reduced Mandibular Motion Due to Osteochondroma of the Coronoid Process of the Mandible

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INFREQUENT reporting of osteochondroma of the coronoid process of the mandible is in all probability due to its rare occurrence, but might also be due to failure of recognition of this entity. In thirty years at the University of Michigan we have observed and treated only one such case. Osteochondroma may present clinical symptoms easily confused with other entities. The condition may not be identified because of unfamiliarity with the symptoms or because of inadequate roentgenograms of the facial structures. The condition presents marked disability but can be cured by a relatively simple operative procedure.

In 1943 Shackelford and Brown [1] first reported on blocking of mandibular movements by osteochondroma of the coronoid process. Later in the same year Brandt [2] described a similar case which he considered as congenital. Shackelford and Brown [3] in 1949 had collected two additional cases and published comments on all four of their cases, with one described as an osseous overgrowth of the zygoma. Brailsford [4] reported one case in the British literature in October, 1952.

In 1956 Holmes [5] presented two cases of osteochondroma of the coronoid process of the mandible and pointed out that the diagnosis might easily be missed on routine roentgenography. With awareness of the condition and proper x-ray films a disabling condition that can be cured by surgical means may be diagnosed.

Thoma [6] believes that this lesion starts as an osteochondroma because it develops on a surface where there is a tendinous attachment. Holmes [5] found no chondromatous element present in his first case.

Van Zile and Johnson [7] reported on a thirty year old man with bilateral exostoses of the coronoid process simulating partial ankylosis of the temporomandibular joint. They postulated that these lesions were probably originally osteochondromas but had matured into exostoses.

FIG. 1. X-ray of facial bones, submental-vertex view, showing the opaque tumor of the right coronoid process of the mandible.

According to Shackelford and Brown [3] the cardinal points in the diagnosis of osteochondroma of the coronoid process of the mandible are progressive, painless mandibular blocking usually beginning when the patient is about fourteen years of age, inequality of movement of the mandible on the two sides with deviation of the mandible to the involved side, and enlargement of the tip of the coronoid process as noted on intraoral digital examination. The

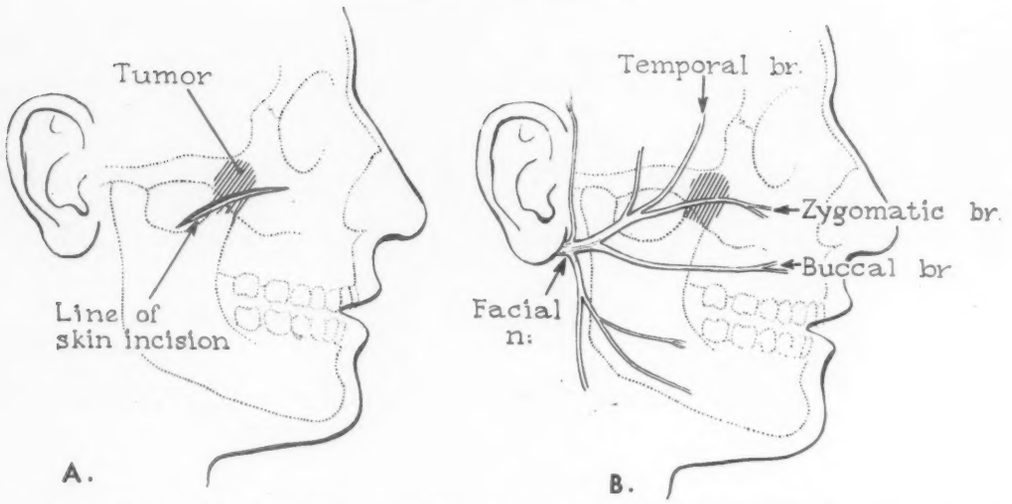

FIG. 2. A, diagram of skin incision to conform with facial lines. B, branches of facial nerve in the area of surgical incision.

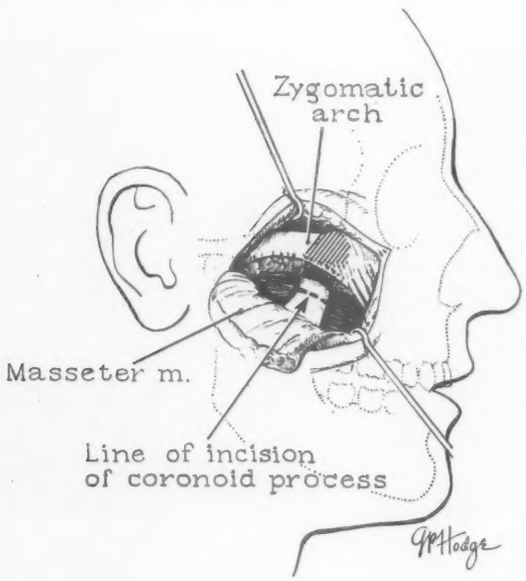

FIG. 3. Reflection of the masseter muscle illustrating captive tumor of the coronoid process behind the zygomatic arch.

condition is generally unilateral but may be bilateral, as reported in one case by Holmes [5]. The temporomandibular joints appear normal. On x-ray examination an unequivocal diagnosis usually can be made with special mandibular views. Shackelford and Brown [3] recommend a submental-vertex projection with the patient's head slightly tilted to the unaffected side.

CASE REPORT

F. W. W., a twenty-seven year old white, normal-appearing farmer, was referred to the Department of Internal Medicine of the University of Michigan Hospital (No. 856538). Approximately four months prior to admission he had noted a general tired feeling and a sensation of stiffness and mild pain in the temporomandibular joints bilaterally. These symptoms gradually progressed, and three weeks before admission he could eat nothing but liquids. One week before admission he had a severe throat infection which was treated with aspirin and antibiotics. He had progressive difficulty in opening his mouth over the past four months. This was associated with increased difficulty in eating and pain in both temporomandibular joints. He complained of great hunger, warmth, nervousness, a weight loss of 40 pounds and difficulty in swallowing solid foods.

The past medical history was not significant. The patient had had a "nervous breakdown" six years previously while in the service. He was told that his "nerves" were bad. A "blackout spell" had required hospitalization for three months, after which the patient had received a medical discharge.

Examination of the mouth and teeth revealed no abnormalities except that the maxillary and mandibular incisors could not be separated more than 8 mm. On oral examination a small mass could be palpated on the anterior border of the right mandibular ramus in the region of the coronoid process. Slight tenderness was present over both temporomandibular joints. Examination of the neck was negative. Otherwise the physical examination was within normal limits.

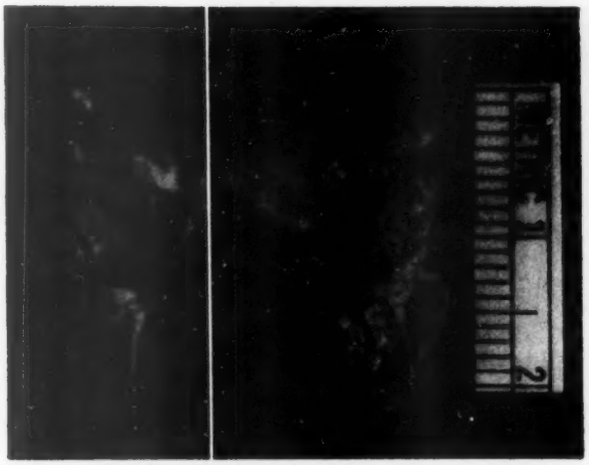

FIG. 4. Photograph of the tumor and superior portion of the coronoid process; anterior and lateral view.

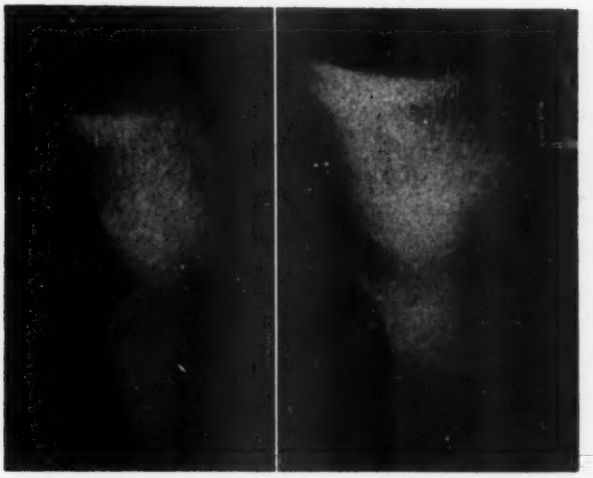

FIG. 5. X-ray of specimen shown in Figure 4; anterior and lateral view.

Laboratory studies showed a normal urine, hemoglobin of 14.0 gm. per cent, hematocrit of 44 per cent and a normal white blood cell count and differential.

The patient was seen by a psychiatrist who believed that he had chronic schizophrenia with conversion. He was seen in the ophthalmology clinic where an unrelated diagnosis of intermittent exotropia and flocculi iridis of the left eye was made. This was thought to be hereditary and was an incidental finding.

X-ray examination of the chest and temporomandibular joints was normal. X-ray films of the bones of the face revealed an unusual abnormality of the coronoid process of the right mandible, with impingement upon the temporal surface of the zygoma. (Fig. 1.) The clinical and x-ray findings were consistent with a diagnosis of osteochondroma of the coronoid process of the mandible.

On November 13, 1956, 2 per cent surital® was given intravenously and a nasal endotracheal tube was passed blindly. The operation was performed under a combination of surital and ether-oxygen through a closed system. With the patient in the recumbent position the face was prepared with pHisohex® and draped. The mouth had been prepared by preoperative dental prophylaxis and by having the patient brush his teeth every two hours for two days with pHisohex. An intraoral incision was made over the ramus on the right, and by blunt dissection with a periosteal elevator the anterior border of the right ramus was exposed. The base of the coronoid process was observed and appeared to be wider than normal in its superior portion. An attempt was made to wedge the coronoid process and tumor from under the zygoma but this was unsuccessful. It was obvious that careful dissection of the tumor was not possible through an intraoral route. The wound was closed with sulk sutures.

An external incision was made over the right zygomatic area starting approximately 1.5 cm. inferior and lateral to the lateral canthus. The incision extended 4 cm. posteriorly and inferiorly toward the tragus of the ear following the lines of skin tension of the face. (Fig. 2A.) The incision was carried into the immediate subcutaneous tissues. To spare seventh nerve branches the anterior edge of the masseter muscle was exposed by blunt dissection. (Fig. 2B.) The masseter was dissected from the zygomatic arch and reflected inferiorly and posteriorly, thus exposing the inferior margin of the zygoma and the coronoid process deep within the wound. By the use of a sharp surgical bur attached to a Jordan Day engine the coronoid process was cut transversely below the base of the tumor. (Fig. 3.) It was with considerable difficulty that the tumor was removed from under the zygomatic arch where it appeared to be encapsulated and contained within a socket-like defect. (Figs. 4 and 5.) In order to complete the separation and free the captive coronoid process, a small amount of the inferior margin of the zygomatic arch was removed. The mouth could be opened immediately to 1.5 cm. between the anterior teeth. The masseter was sutured to the periosteum of the

zygoma, and the wound was closed in layers with plain No. 4-0 catgut and No. 5-0 nylon. The patient was returned to the recovery unit in excellent condition.

The pathologist's report stated: "After decalcification this specimen consists of abundant periosteum. There is also cartilage and bone. Proliferation of cartilage. Osteochondroma."

The postoperative course was uneventful except for edema of the right cheek and an oral temperature elevation to 100.8°F. for the first day. Postoperatively the patient was treated with antibiotics and cold compresses to the face. At the time of discharge, six days after surgery, the maximum opening was 2.5 cm. in the incisor region. He moved soon afterward to another state and cannot be contacted.

SUMMARY

Osteochondroma of the coronoid process of the mandible is an uncommon condition. Methods of diagnosis and treatment are discussed and one additional case is reported.

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End of Symposium on Maxillofacial Surgery

The Treatment of Acute Perforated Gastric and Duodenal Ulcers

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Of fifty-six patients receiving treatment for acute perforated gastric or duodenal ulcers in our clinic between April 1, 1952, and December 31, 1955, forty-two (or 75 per cent) were treated by primary resection (Billroth I or II procedure) and fourteen (or 25 per cent) by simple suture. There was only one resulting death, that of a seventy-one year old woman who had entered the hospital forty-eight hours after the perforation had occurred. Diffuse peritonitis was then present and simple suture was performed. Ten days later the patient again had to be operated upon because of wound separation; she died twelve hours later from cardiac failure and aspiration pneumonia. These results indicate that if the strict contraindications for operative procedures such as presence of diffuse peritonitis and/or advanced age are taken into consideration, primary resection provides no added risk to the patient. The advantages of this method are self-evident since the patient is permanently rid of his ulcer, and a second operation made necessary by the palliative approach and usually complicated by extensive adhesions is no longer required.

This report is an analysis of the results of primary resection in the treatment of acute perforated ulcers from data made available in our clinic, where the method has been in use over the past thirty years. Included are 244 patients operated upon from 1935 to 1951, inclusive. The report has been prompted by the fact that primary resection has not found universal acceptance as the method of choice.

As the majority of the 302 patients treated for acute perforated ulcer in the past twenty years (1935 to 1955) were submitted to surgery before the advent of antibiotics and before our knowledge of fluid and electrolyte balance had become fully developed, the total lethality seems to be rather high. Of 195 patients who underwent primary resection during the entire period from 1935 to 1955, 5.1 per cent died; of those treated conservatively, seven of the thirty-six treated by partial resection and twenty-five of the seventy-one treated by simple suture died. However, if one considers that during the cited period mortality from surgical interventions has shown a steady decline over the years regardless of the method used or the patient treated, the relatively low risk afforded by the primary resection of acute perforated ulcer becomes rather evident.

The following are the principles on which treatment of acute perforated gastric and duodenal ulcers is based:

Radical surgery, whereby primary resection is carried out in the presence of perforation, with simple suture being indicated in cases of poor risk patient. Inadequate technical training may under circumstances force the operator to decide in favor of the latter method [*9,14,15,18, 19,31,35,40,41,43,57,60,73,75*]. These views are shared by other authors who have also enumerated additional limitations [*1,5,7,16,39,59, 65,74*]. This method has not found universal favor in the United States [*5,19,75*].

Palliative surgery, whereby simple suture is practiced at the rupture site [*3,6,8,12,22,24,26, 32–34,37,45,49–51,56,64,67,70*].

Pure conservative treatment, consisting of constant aspiration of the gastric or duodenal contents, parenteral feeding, chemotherapy, and constant and close watch of the patient's clinical condition. If the symptoms reduce in intensity, no resort is made to surgery. One of the first suggestions in this direction was made by Wangensteen [*71*]. Additional observations along these lines have been published by numerous authors [*2,4,7,10,13,17,20,21,25,29,36,38,44,48,52–54,58,61–63,66,69*].

The cases included in the present report are considered from the following standpoints: time of perforation, age and sex of patient, previous history, location of the perforation, influence of chemotherapy, postoperative complications, cause of death and analysis of long-term results.

TABLE I
SIMPLE SUTURE

Author	No. of Cases	Period	Primary Lethality (%)
Burbank and Roe [*8*]	103	1896–1915	44.2
	334	1916–1939	27.2
	289	1940–1951	9.4
Thompson [*64*]	424	1921–1934	28.7
Berson [*3*]	154	1923–1940	15.2
Mayo and Fitchett [*37*]	160	1925–1948	12.5
Ingram and Ervin [*24*]	132	1927–1947	15.4
McKinnon [*33*]	176	1929–1946	21.6
	82	1929–1937	29.3
	94	1938–1946	14.9
Schaefler [*51*]	102	1936–1949	20.6
Mage and Payson [*34*]	219	1936–1950	10.5
Jones et al. [*26*]	455	1938–1948	14.1
Raw [*45*]	312	1939–?	14.4
Jones et al. [*27*]	340	1947–1951	7.9

TABLE II
RESECTION ATTEMPTED

Author	No. of Cases	Period	Resections (%)	Primary Lethality (%)
Yudin [*73*]	1,372	1928–1937	69.0	15.6
Eberle [*15*]	268	1934–1950	53.4	16.0
	185	1934–1946	45.0	18.4
	73	1947–1950	66.0	10.9
Oterdoom and Quast [*43*]	228	1938–1951	40.0	20.3
Lowdon [*31*]	65	1951	78.4	6.1
Author's cases	244	1935–1951	77.4	16.8
	63	1935–1940	65.0	22.2
	106	1941–1946	86.4	15.1
	75	1947–1951	77.3	14.7
	56	1952–1955	75.0	1.87*

* During the past 4 yr. we have lost 1 more patient, not as a result of the perforation but following a massive intestinal hemorrhage. The perforation had been successfully treated by conservative means but resection was probably undertaken too late.

PRIMARY OPERATIVE LETHALITY

Of 244 patients with acute perforated ulcers seen during the period from 1935 to 1951 (these cases were submitted to a close analysis), fifty-one died, resulting in a primary lethality rate of 16.8 per cent, or 43.3 per cent in those cases in which simple suture was chosen as the method of treatment. Among those treated by primary resection, when considering only those cases in which the ulcer was included in the resected portion, the lethality rate was 6.1 per cent. This latter figure appears rather high today; however a comparison of our results with data compiled by other authors over similar periods indicates essential agreement. (Tables I and II.)

As the decrease in primary lethality indicated in Tables I and II is essentially similar, we are inclined to correlate it to the improvements in pre- and postoperative treatment rather than to the choice of procedure.

Time of Perforation and Peritonitis. From data in Table III it is clear that prognosis remains good if surgical treatment is instituted within twelve hours after perforation, with a satisfactory course still being possible after twenty-four hours.

The extent of peritonitis appears to affect prognosis more definitely than the time elapsed since acute perforation and, as seen in Table IV, the presence of diffuse peritonitis calls for a guarded prognosis even in those patients on whom surgery was performed within the six-hour limit.

Age and Sex of Patient. Our experience has been similar to that of other authors [*7,24,34*]. Analysis of the influence of age on the lethality caused by primary resection shows a marked increase in lethality above the age of fifty-five. The ratio of men to women in our series was 13:1; however the ratio of primary lethality

TABLE III
TIME OF PERFORATION

Procedure	Up to 6 Hr.		6 to 12 Hr.		12–24 Hr.		24 Hr. Past		Unknown	
	No.	Died	No.	Died	No.	Died	No.	Died	No.	Died
Primary resection	84	6	47	1	7	2	..	..	15	1
Partial resection	22	2	6	2	3	2	2	..	3	1
Simple suture	18	7	17	6	9	5	7	5	4	1
Total	124	15	70	9	19	9	9	5	22	3

TABLE IV
EXTENT OF PERITONITIS

Procedure	Immediate Vicinity of Perforation Only		Upper Abdominal Peritonitis		Superficial Diffuse Peritonitis		Severe Diffuse Peritonitis		Unknown	
	No.	Died	No.	Died	No.	Died	No.	Died	No.	Died
Primary resection	24	1	73	3	41	2	5	4	10	..
Partial resection	1	....	11	1	14	....	8	4	2	2
Simple suture	3	2	8	1	21	9	22	12	1	..
Total	28	3	92	5	76	11	35	20	13	2
Lethality (%)	..	10.8	..	5.4	..	14.5	..	57.5	..	..

showed a reverse relationship, being 41 per cent among women to 15 per cent among men. On the other hand, lethality figures of women subjected to resection were essentially similar to those of men.

Previous History. Acute perforation as the initial sign of the presence of an ulcer was relatively rare in our series, occurring in only 10 per cent of the cases. Another 10 per cent of the patients admitted having noted gastrointestinal disturbances several days prior to perforation. Eighty per cent had a long ulcer history, running over several years, with 24 per cent of the total having had roentgenological verification.

Site of Perforation. Including ulcers located in the pylorus with those of the duodenum, we find that the rupture occurred in the duodenum in 67 per cent of the cases, and in the gastric region in 33 per cent. Regardless of how we choose to classify the localization, it is unanimously agreed that the most frequent site of acute perforation is in the parapyloric region, with the upper gastric sector accounting for the least number of cases. The last category exhibited the highest lethality percentage (44 per cent) in our series.

Influence of Chemotherapy. Lethality showed a significant difference only in the simple suture series when pre- and postonset of chemotherapy were compared. Prior to chemotherapy, lethality in this group was 51 per cent (thirty-nine cases); it was then reduced to 25 per cent (sixteen cases) after the introduction of chemotherapy. Consideration of a most recent series of fifty-six such patients with but one death makes it clear, however, that the precise part played by chemotherapy in reducing mortality in the early series is extremely difficult to assess. Progress in anesthesia, fluid replacement therapy and chemotherapy all have combined to improve results in patients submitted to surgery. Evaluation of the exact contribution by individual factors falls within the realm of the impossible.

Postoperative Complications. The intraperitoneal cavity and the abdominal wall were the site of abscess formation in twenty-seven instances. With one exception these were all

TABLE V

DEATHS IN CASES IN WHICH TREATMENT WAS SIMPLE SUTURE

Case No.	Age (yr.) and Sex	Time of Perforation (hr.)	Peritonitis	Drainage	Survival Time (days)	Autopsy Findings	Main Cause of Death
1	47 ♂	12	Superficial diffuse	+	26	Diffuse peritonitis, pneumonia	Diffuse peritonitis
2	38 ♂	6	Severe diffuse	+	13	Pneumonia, hemorrhage	Hemorrhage
3	75 ♂	6	Upper abdomen	+	3	Diffuse peritonitis, acute perforation of additional ulcer	Diffuse peritonitis, acute perforation of additional ulcer
4	46 ♂	6	Immediate vicinity of perforation only	+	6	Diffuse peritonitis, pulmonary embolism, cardiac failure	Diffuse peritonitis
5	36 ♂	24	Severe diffuse	+	7	Diffuse peritonitis, pneumonia	Diffuse peritonitis
6	59 ♂	12	Superficial diffuse	+	7	Autopsy not performed	Pulmonary embolism
7	67 ♂	12	Severe diffuse	+	2	Diffuse peritonitis, pneumonia	Diffuse peritonitis
8	60 ♂	12	Superficial diffuse	+	3	Diffuse peritonitis	Diffuse peritonitis
9	44 ♂	6	Superficial diffuse	+	17	Diffuse peritonitis, pneumonia	Diffuse peritonitis, pneumonia
10	55 ♂	24	Severe diffuse	+	2	Diffuse peritonitis, cardiac failure	Diffuse peritonitis
11	87 ♀	12	Superficial diffuse	+	1	Diffuse peritonitis, cardiac failure	Diffuse peritonitis
12	40 ♂	24	Severe diffuse	+	4	Diffuse peritonitis	Diffuse peritonitis
13	58 ♂	24	Severe diffuse	+	45	Diffuse peritonitis, pneumonia, cardiac failure	.....
14	60 ♀	24	Severe diffuse	+	7	Diffuse peritonitis, hemorrhage	Hemorrhage
15	67 ♂	6	Superficial diffuse	+	3	Pneumonia, cardiac failure	Cardiac failure
16	46 ♂	12	Severe diffuse	+	10	Insufficiency at site of closure of perforation, ileus, pneumonia	Ileus, pneumonia
17	71 ♂	6	Superficial diffuse	+	30	Diffuse peritonitis, pneumonia	Diffuse peritonitis
18	48 ♂	>24	Severe diffuse	+	3	Diffuse peritonitis, cardiac failure	Diffuse peritonitis
19	33 ♂	>36	Immediate vicinity of perforation only	+	11	Diffuse peritonitis	Diffuse peritonitis
20	59 ♀	>48	Severe diffuse	+	38	Ileus, hemorrhage	Hemorrhage
21	74 ♂	6	Superficial diffuse	+	7	Ileus, acute perforation of additional ulcer, cardiac failure	Acute perforation of additional ulcer (uremia)
22	68 ♂	?	Upper abdomen	−	1	Diffuse peritonitis, cardiac failure	Diffuse peritonitis
23	64 ♀	>24	Severe diffuse	+	1	Insufficiency at site of closure of perforation, diffuse peritonitis, pneumonia	Diffuse peritonitis
24	68 ♀	24	Severe diffuse	+	20 min.	Diffuse peritonitis	Diffuse peritonitis, acute pulmonary edema

TABLE VI

DEATHS IN CASES IN WHICH TREATMENT WAS PRIMARY RESECTION

Case No.	Age (yr.) and Sex	Time of Perforation (hr.)	Peritonitis	Drainage	Survival Time (days)	Autopsy Findings	Main Cause of Death
1	40 ♂	6	Upper abdomen	+	12	Insufficiency of duodenal stump (faulty closure), diffuse peritonitis, pulmonary embolism, pneumonia	Diffuse peritonitis, pulmonary embolism
2	26 ♂	?	Immediate vicinity of perforation only	+	9	Insufficiency of gastric anastomosis, diffuse peritonitis, hemorrhage	Diffuse peritonitis
3	42 ♀	6	Upper abdomen	+	3	Pneumonia, cardiac failure	Cardiac failure
4	57 ♂	6	Severe diffuse	+	17	Insufficiency of gastric anastomosis, diffuse peritonitis, pneumonia	Diffuse peritonitis
5	28 ♂	24	Upper abdomen	+	17	Insufficiency of gastric anastomosis, of duodenal stump (faulty closure), and at site of closure of perforation; diffuse peritonitis	Diffuse peritonitis
6	57 ♂	6	Superficial diffuse	+	7	Autopsy not performed	Diffuse peritonitis
7	48 ♂	12	Superficial diffuse	+	8	Insufficiency of gastric anastomosis, diffuse peritonitis, pulmonary embolism, pneumonia	Diffuse peritonitis
8	44 ♂	6	Severe diffuse	+	6	Insufficiency at site of closure of perforation, diffuse peritonitis	Diffuse peritonitis
9	20 ♀	24	Severe diffuse	+	4	Diffuse peritonitis	Diffuse peritonitis
10	56 ♂	6	Severe diffuse	+	10	Insufficiency of duodenal stump (faulty closure), diffuse peritonitis, cardiac failure	Diffuse peritonitis
11	59 ♂	24	Severe diffuse	+	4 hr.	Diffuse peritonitis, pulmonary embolism, pneumonia, cardiac failure	Pulmonary embolism
12	48 ♂	12	Superficial diffuse	+	7	Diffuse peritonitis, pneumonia	Diffuse peritonitis
13	49 ♂	6	Severe diffuse	+	11	Diffuse peritonitis, pneumonia, hemorrhage	Hemorrhage
14	70 ♂	6	?	+	4	Hemorrhage, cardiac failure	?
15	71 ♂	12	?	?	7	Pneumonia, cardiac failure	Pneumonia (uremia)
16	48 ♂	24	Severe diffuse	..	7	Diffuse peritonitis, pneumonia, cardiac failure	Diffuse peritonitis
17	48 ♂	?	Severe diffuse	..	8	Insufficiency of gastric anastomosis, diffuse peritonitis, pulmonary embolism, cardiac failure	Diffuse peritonitis (uremia)

cases treated prior to the introduction of chemotherapy.

Pulmonary complications (bronchitis, bronchopneumonia, exudative pleuritis or pleural empyema) occurred in seventeen cases. The fear that general anesthesia might predispose to the development of pulmonary complications is not confirmed by the present results, such complications occurring with greater frequency in patients operated upon under local anesthesia.

Intestinal hemorrhage as a complication occurred most frequently in cases in which palliative surgery was the method of choice. Its origin was usually an eroded artery located within the ulcer crater. Three patients of the present series treated by palliative surgery died following massive hemorrhage from the ulcer site.

Postoperative ileus, or subileus, was noted three times. Cases of paralytic ileus as a result of diffuse peritonitis have not been included here. Conservative therapy was successful in only one of the three cases.

Three patients passed from postoperative oliguria into anuria, death following in uremia.

Analysis of Causes of Death. Tables v and vi summarize the clinical course and necropsy findings in the forty-one patients who died.

Greater extent of operation and the persisting ulcer make patients submitted to partial resection appear as poor risks when compared to patients treated by primary resection. For this reason each form of treatment was considered separately in the analysis of the causes of death.

Ten of the 153 patients in whom the ulcer was resected and seven of the thirty-six upon whom only partial resection was performed died. (Table vi, Cases 5, 8, 9, 11, 14, 15, 17.)

Seven of the 153 patients with resected ulcers exhibited diffuse peritonitis at the time of the operation; four of these seven died and three survived despite their advanced clinical condition. Death came in one instance from an acute pulmonary embolism. Death was attributed to the presence of diffuse peritonitis in four other cases, two of which exhibited additionally faulty closure of the duodenal stump, another pulmonary embolism and the fourth intestinal hemorrhage and cardiac failure in the presence of glomerulonephritis and hypertension.

Of the thirty-six patients who underwent partial resection, four of the six showing signs of diffuse peritonitis died. Death followed pulmonary embolism in one case; in the three other cases death was attributed to diffuse peritonitis and multiple failure of sutures in one, intestinal hemorrhage in another, and bilateral pneumonia in the presence of uremia in the third.

TABLE VII
LONG TERM RESULTS

Data		Primary Resection	Simple Suture
No. questionnaires mailed		170	29
Replies received		103	17
No dead of replies received		8	5
Of returned questionnaires that could be evaluated:	Total	95	12
	Free of any difficulties	65	1
	Occasional difficulties; services of doctor not required	15	..
	Services of doctor required; no loss of working time	7	2
	Services of doctor required, with loss of working time	6	1
	Subsequent operations	2	8

Diffuse peritonitis dominated the picture as the cause of death in patients treated by simple suture as well. This emphasizes the fact that in the presence of diffuse peritonitis even a relatively minor procedure may prove dangerous, and provides the reason why this condition requires strict attention when contraindications for primary resection are considered. Results of this series provide no statistically significant basis to substantiate the preference of simple suture over primary resection in the presence of diffuse peritonitis.

Further complications noted in the cases of simple suture were three fatal hemorrhages from sutured ulcers, and two instances of acute perforation of additional ulcers overlooked at the time of suturing. Resection probably could have prevented these fatal accidents.

Long-Term Results. In order to evaluate the long-term success of the various methods, questionnaires were mailed to patients who had been operated upon previously. Questions asked were as follows:

"1. Have you had any stomach or intestinal difficulties since the time of the operation? If so, what kind?

2. Have these difficulties required the service of a doctor?
3. Have these difficulties caused you to lose any working time? If so, for how long?
4. Did treatment which you may have received require hospitalization?
5. Was an operation performed? If so, when?
6. Remarks:"

The results obtained from returned questionnaires are detailed in Table VII.

Nine of the twelve patients submitted to simple suture were still considerably limited in their daily activity, some being required to stop working from time to time. Eight of these nine required additional surgery for symptoms induced by the ulcer present, such as massive hemorrhage or progressive stenosis. Two patients died following the second operation, while six who were subjected to resection were permanently freed of their gastrointestinal troubles.

On the other hand, of ninety-five patients who underwent primary resection, sixty-five were free of difficulties for periods ranging from one to seventeen years. Only eight (i.e., 8.4 per cent as contrasted to seventy-five per cent in the case of simple suture) were compelled to interrupt work because of gastrointestinal difficulties.

CONCLUSIONS

Findings in forty-two cases of acute perforated gastric and duodenal ulcers treated by primary resection indicate that such a procefure, if considered in the light of definite indications, means no added risk to the patient. Comparing the data published by clinics where resection is chiefly carried out with others where simple suture is the method of choice reveals little difference in the lethality figures. These figures have exhibited definite reductions everywhere, not due to the choice of method but to the improvement in postoperative care.

Primary resection and the contraindications to its use should receive careful evaluation. Advanced age (over sixty) and diffuse peritonitis in the face of acute perforation are factors conducive to a guarded prognosis. We have not been able to substantiate the possible advantage of simple suture over primary resection in the presence of the enumerated contraindications. Needless to say, rigid rules under these extreme circumstances are valueless. If age, the patient's condition and peritonitis combine to give a clinical picture which calls for the briefest possible type of surgical intervention, resection should be abandoned. The important points to be considered in establishing the surgical indications may be summarized as follows:

Resection. (a) Time of perforation, not always a determining factor; peritonitis and widespread contamination of abdominal contents as established at operation may favor the choice of simple suture; (b) precaution must be exercised when patients more than sixty years of age are considered; (c) absence of concomitant illness; (d) technical skill of the surgeon; the tissue dissociation which accompanies the edema following perforation makes resection at this stage technically easier; (e) presence of bleeding ulcer (when no strict contraindications are evident); (f) presence of multiple ulcers; and (g) suspected perforation of gastric carcinoma.

Simple Suture. This method should be considered for patients who do not fulfill the conditions for resection. Two-thirds of these patients require a second operation, at which time resection is usually made difficult by scarring in the anterior duodenal wall.

Conservative Treatment. The greater incidence of abscesses does not make this method appear particularly favorable. However, it does have one great advantage in that it allows time to bring the patient out of his initial shock and, regardless of duration, allows some certainty that the peritonitis will not advance very rapidly.

The factors contributing to lower lethality these past four years among patients with acute perforated ulcers submitted to surgery are: (1) careful evaluation with regard to indications for surgery; (2) chemotherapy; (3) development of better methods of combating shock; (4) improvements in anesthesia; (5) improved and systematic closure of the duodenal stump; faulty or inadequate closure has been a chief cause, giving rise to local postoperative complications following resection; and (6) realization of the value of continuous suction.

SUMMARY

An attempt has been made to evaluate the surgical indications used in differentiating between primary resection or simple suture as a choice of treatment for acute perforated gastric

or duodenal ulcers. Factors influencing lethality following surgery have been analyzed and the data of our department compared with results published by other clinics. It was found that if the indications for surgery are carefully weighed, primary resection brings no added risk over and above that of simple suture.

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Subtotal Gastrectomy in the Treatment of Peptic Ulcer

EVALUATION OF 220 CASES

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DURING the last fifteen years subtotal gastrectomy has been our method of choice in the surgical treatment of peptic ulcer at the Hertzler Clinic. The recent trend to combine vagotomy with less extensive gastric resection has made it advisable to evaluate our surgical material before adopting or rejecting new surgical procedures. The thought that final judgment as to the relative merits of hemigastrectomy with vagotomy and subtotal gastric resection would result from this analysis was never seriously entertained, but the belief that further evidence might result in an eventual judgment was considered, especially in view of a study of antrectomy with vagotomy currently in progress at this institution. This, coupled with a desire to confirm or deny an impression that the dumping syndrome was an insignificant postgastrectomy complaint prompted this study; as is common with many such undertakings as these, a seemingly unrelated fact was unearthed—a fact which cries for an explanation as yet unsupplied. In these 220 cases, with an average age of fifty-three years, only one case of hypertension was found. It is unlikely that such a low incidence of hypertension could be found in any random selection of over 200 patients in that age group. Earnest inquisition of authorities and a search of the literature brings to light no similar finding and no reasonable explanation.

MATERIAL AND METHODS

This study is based on 220 cases of subtotal gastrectomy performed for benign lesions of the stomach and duodenum at the Halstead Hospital between January, 1943 and July, 1955. The average age of the patients in this group was 53.6 years, and the sex incidence was 184 men and thirty-six women or a ratio of 5.1 to 1. Of these 220 patients, 169 had duodenal ulcers, forty had gastric ulcers, seven had marginal ulcers, and four had other complications such as acute hemorrhagic gastritis or gastrojejunal colic fistula which resulted from gastric surgery performed elsewhere.

Five of the 220 patients in this series, failed to survive gastrectomy. The operative mortality rate for the patients with duodenal ulcer was 2.7 per cent. There were no deaths among the patients with gastric or marginal ulcers.

Of the 215 survivors, 195, or 90.7 per cent were followed up closely enough to merit inclusion in this statistical analysis. The information for the follow-up was obtained in most cases by a combination of personal interview and physical examination plus a questionnaire. If any question of abnormality arose, the patient was requested to undergo appropriate laboratory and roentgenographic diagnostic examination, and in many cases complied. The result was classified as excellent if: both examiner and patient so stated; the patient was given no diet or medication; there were no signs or symptoms of recurrence; and if the patient had manifested a weight gain. The result was considered good if: both examiner and patient so classified; there were no signs or symptoms of recurrence; there was no weight loss; and if the patient required only a minor dietary restriction but no medication.

The result was classified as fair if: either examiner or patient felt any dissatisfaction; the patient found it necessary to restrict his diet and take medicine; and if there was no recurrence of the symptoms of pain, nausea,

emesis or bleeding while on this regimen. The result was classified as a failure if the patient continued to have symptoms without bleeding and without radiological evidence of recurrence.

These patients were followed up for from one to twelve years with the average length of follow-up time being 4.2 years as shown in Table I.

TABLE I
LENGTH OF FOLLOW-UP

Years Followed Up	No. of Patients	Per cent
10 or more	10	5.1
9	15	7.8
8	12	6.2
7	10	4.6
6	10	5.1
5	9	4.6
4	50	25.8
3	41	21.1
2	28	14.5
1	10	5.1
Total	195	100.00

TABLE II
OCCUPATIONAL INCIDENCE OF ULCER

Occupation	No. of Cases	Per cent
Farmer	66	30.0
Laborer	53	24.0
Skilled laborer	34	66.1
Businessman	12	5.4
Executive	10	4.5
Clerk	11	5.0
Housewife	31	14.0
Retired	2	1.0
Total	220	100.00

The compilation of occupational incidence of disease, as seen in Table II, produced an interesting deviation from the usual concept of the busy, harried, meticulous executive as the ulcer type. The bulk of patients in this series were farmers, laborers and housewives. In all truth, however, the modern housewife and farmer do play an executive role and are subject to like stress.

All these cases were seen first, and most of them were treated for a varying length of time, by the medical department. The symptoms, as shown in Table III, were the usual ulcer symptoms to a greater or lesser degree. The average duration of symptoms was 9.2 years.

Indication for Surgery. The indications for surgery at this institution conform to the standard indications: (1) intractability of symptoms; (2) intractability of patient to management; (3) uncontrollable tendency toward hemorrhage; (4) obstruction due to cicatricial narrowing; (5) perforation or past perforation with persistence of symptoms; and (7) gastric ulceration without adequate response to treatment. The patients falling in these categories were seen by the surgical department in consultation with the medical department and the decision made for or against gastrectomy.

TABLE III
INCIDENCE OF ULCER SYMPTOMS

Symptoms	No. of Cases	Per cent
Pain	214	97
Gas and bloating	119	54
Nausea and emesis	118	54
Weight loss	103	46
Bleeding	54	24

Determinations of gastric acidity were accomplished in all of these cases preoperatively, with the free hydrochloric acid measuring 56.2 per cent on the average. Determinations postoperatively were performed in many cases and a significant decrease in gastric acidity registered. No correlation between gastric acidity and recurrence rate or between gastric acidity and failure rate could be found.

Type of Operation. In all operated cases except two the technic employed was the Hofmeister-Polya antecolic anastomosis with 65 to 75 per cent gastrectomy. If the omentum proved bulky, it was sacrificed. In all cases the stoma constituted one-third of the gastric stump.

Postoperative Care. At dismissal these patients were returned to the medical department in consultation, and from that point on, were cared for jointly by the medical and surgical departments. The medical department placed each of these patients on a diet and continued medical management for a period of six months to one year. The medical regimen has changed throughout the years but consisted, in the

main, of an Alvarez smooth diet, a vitamin, an antispasmodic, and slight sedation such as provided by ½ gr. of phenobarbital. At the end of this care and follow-up period the satisfactory patients were released as cured, given no diet and without medication.

TABLE IV
RESULTS OF SUBTOTAL GASTRECTOMY IN 220 PATIENTS

Results Classified	No. of Patients	Per cent
Adequate follow-up	195	90.7
Inadequate follow-up	26	9.3
Deaths	5	2.7
Excellent results	113	59.8
Good results	57	30.3
Satisfactory results	169	90.1
Fair results	10	5.2
Failures	3	1.5
Recurrences	3	1.5
Dumping syndrome	4	2.0

Postgastrectomy Syndrome. The syndrome is considered in this clinic as a symptom complex associated with food intake, and in most instances occurs during or shortly after a meal. It is characterized by or associated with varying degrees of epigastric fullness with nausea, palpitation, dizziness, a sense of warmth and weakness, pallor and sweating, and occasional vomiting, or a combination of these manifestations. These symptoms are usually relieved by lying down or restricting diet, or both. A history of this postgastrectomy complication was sought by at least two examiners, one medical and one surgical, during the postoperative interview. The questionnaire asked for this information in different form but not in such form as to constitute a leading question. The results are tabulated in Table IV and discussed.

RESULTS

Six of the 195 patients who could be followed up adequately, died one to three years following gastric surgery. Five of these six patients died of unassociated disease but one died of an intestinal obstruction and its sequelae two years postoperatively. Of the remaining 189 patients, 113, or 59.8 per cent, were judged to have excellent results, while fifty-seven, or 30.3 per cent, were classified as having good results, giving a total of 170 patients, or 90.1 per cent with a satisfactory result. Fair results were obtained in ten patients for a 5.2 per cent questionable result. Four of these patients, or 2 per cent, could be said to have postgastrectomy syndrome. Three of these four have been able, subsequently, to overcome their disability by such measures as smaller meals and restriction of fluid intake with meals. Three patients in this series, or 1.5 per cent, are known to have had recurrences, and another 1.5 per cent must be considered frank failures due to symptomatology. These latter three have not had bleeding and are roentgenographically normal but they complain of no improvement in symptoms following surgery.

TABLE V
OPERATIVE MORTALITY

Patient	Age	Ulcer Site	Cause of Death	Postoperative Day
A. K.	66	Duodenal	Uremia	7th
R. M.	61	Duodenal	Subphrenic abscess	25th
C. E.	64	Duodenal	Uremia; shock	3rd
F. S.	51	Duodenal	Uremia	5th
E. N.	55	Duodenal	Uremia	8th

Five of the 220 patients failed to survive the operation for a mortality rate of 2.7 per cent. The causes of death are included in the mortality table. The average morbidity was just under two weeks or 13.9 days. These results are tabulated in Table V.

COMMENTS

One of the purposes of this study was to determine the incidence of postgastrectomy syndrome at this clinic and if found low, as conjectured, an effort made to explain why it did not constitute a problem.

The mechanism producing this condition seems to be an egress of fluid by the jejunal loop in an effort to dilute the hypertonic solution that has been dumped by a non-retentive stomach. This produces a mechanical distention of the jejunal loop with hypermotility and occasionally nausea and vomiting. The excess fluid comes from the blood stream with resultant decrease in blood volume; it is this sudden decrease in blood volume that is responsible for a share of the vasomotor symptoms. One

to two hours postprandial there is a rapid rise of blood sugar to high levels, followed by a compensatory precipitous fall to hypoglycemic levels, a rebound hypoglycemia with associated symptoms. On the basis of this theory, the three patients who complained of postgastrectomy syndrome with subsequent relief were advised to restrict fluids and sweets at mealtime, and obtained relief.

TABLE VI
SUBTOTAL GASTRECTOMY

Authors	No. of Cases	Results (%)	Mortality (%)	Recurrence (%)	Dumping (%)
Bell [2].....	154	86.4	3.8	5.5	7.8
Jordan [3].....	215	87.0	1.9	4.8	15.0
Chesky.....	220	90.1	2.7	1.3	2.0
Everson [16]....	348	92.6	4.9	2.2	50.8
Gardner [7].....	123	84.0	8.9	5.0	6.0
Druckerman [4].	220	93.0	0.0	4.5	1.8

TABLE VII
VAGOTOMY PLUS

Authors	No. of Cases	Results (%)	Mortality (%)	Recurrence (%)	Dumping (%)
Crile [6].....	83	89.0	1.1	1.0	....
Dragstedt [11]..	219	81.0	1.8	5.8	....
Everson [16]....	178	84.0	1.1	7.6	52
Gardner [7].....	77	80.5	1.3	2.6	7.8
Druckerman [4].	165	98.0.	1.2	0.0	3.0

Lahey [1] believed that the type of gastric resection he performed had at least something to do with the very limited occurrence of this complication. He employed the Hofmeister-Polya type of anastomosis with a buttressing of the distal jejunal loop over the closed upper two-thirds of the stomach, anchoring the uppermost stitch to the ligature of the gastrohepatic omentum. This produced an angulation of such a nature as to act as a trap to prevent the rapid dumping of the gastric contents with resulting mechanical distention. The same variation as described by Lahey was employed in our own series of Hofmeister-Polya anastomoses, but it was considered at the Hertzler Clinic that the primary reason for the low incidence of "dumping" was due to the postoperative medical management. This management consisted largely of dietary restriction, medication and frequent medical consultation for a period of six months or more, or until the patient's stomach had enlarged and his internal economy had stabilized.

The mortality rate in our series, while it compares favorably with other reported series, is higher than we feel it should be. The study spans a period of nearly fourteen years during which surgical technics, anesthetic technics, fluid therapy, supportive care, etc. have changed. Since 1950, only two deaths have occurred in nearly 150 cases, or a mortality rate of 1.3 per cent. Prior to 1950, most of the gastric resections were performed under continuous spinal anesthesia which led to several cases of neurogenic shock and an occasional uremia and death. Since the advent of general anesthesia used routinely in all gastrectomies, no cases of shock have been encountered and the death rate has decreased. Equally important in this decrease in mortality rate has been the more liberal use of whole blood, the wiser use of fluid therapy and antibiotics, and an improvement in surgical technics.

Morbidity as reflected by length of hospital stay, has likewise decreased between 1950 and the present for similar reasons. Fewer postoperative complications are now encountered. With early ambulation, Kaslow tubes and indwelling catheters are removed earlier with less ileus and less cystitis, and phlebitis has ceased to be a postgastrectomy complication. The average hospital stay since 1950 has been only ten days.

The results obtained in this series of 220 gastrectomies for peptic ulcer compare favorably with published series [2–4,6,7,9] of a similar size and nature. They also compare favorably with similar series [4,6,7,9,10,11] in which the procedure was that of vagotomy and hemigastrectomy and/or vagotomy and subtotal gastrectomy, although in the latter two procedures there seems to be a great divergence of results. This may stem from the relatively recent resurgence of vagotomy to popularity with consequent short periods of follow-up.

Glenn [10] and Lahey [1], among others, believe 70 per cent gastric resection to be the procedure of choice. Dragstedt [11] and Smith-

wick [9], among others, believe that vagotomy combined with either gastric resection or hemigastrectomy or gastroenterostomy yields a better result. Jordan and co-workers [14], point out after an extensive study, that the results following subtotal gastric resection alone were superior to those following vagotomy with gastroenterostomy and equal to those following gastric resection with vagotomy in the surgical treatment of duodenal ulcer. This study embraced such factors as mortality, morbidity, postgastrectomy sequelae, ulcer recurrence and weight gain. It would seem that as yet, the results are too inconclusive to obtain a good comparison or to formulate an intelligent conclusion. This is borne out in Table VI and Table VII in which an effort has been made to compare results.

It is our opinion, based on our results, that subtotal (65 or 70 per cent) gastric resection remains the surgical treatment of choice for gastric and duodenal ulcers in all except the aged and poor risk patients. Vagotomy seems to be indicated for marginal ulceration. We stand ready to revise this opinion if the results of a series of vagotomies and hemigastrectomies now in progress at this institution, and presently to be published, proves superior to subtotal gastrectomy, or if other subsequent published evidence so indicates.

SUMMARY

Among the 220 patients with an average age of 53.6 years (184 men and thirty-six women) with benign peptic ulcer who were subjected to subtotal gastrectomy at the Hertzler Clinic and Halstead Hospital in the years 1943 to 1955, only three (1.5 per cent) suffered proved recurrence, all of them anastomotic. There were five operative deaths, a mortality rate of 2.7 per cent, all of them following resection for duodenal ulcer.

Results in this series of gastrectomies, obtained by a 90.7 per cent adequate follow-up consisting of personal interview and questionnaire, showed 90.1 per cent of the patients with a satisfactory result, 5.2 per cent with a fair result and 1.5 per cent with failure.

The dumping syndrome obtained in four of the 195 cases that were followed up, is discussed and an explanation for the low incidence presented.

The mortality rate (2.7 per cent) and morbidity (fourteen days) are presented, discussed and compared, together with late results of operative procedures to other similar studies following subtotal gastrectomy and hemigastrectomy with vagotomy.

CONCLUSIONS

Comprehensive analysis of the results of subtotal gastrectomy for peptic ulcer with emphasis on mortality, recurrences, postgastrectomy syndrome and later sequelae is presented.

The results obtained in this series of 220 subtotal gastrectomies demonstrate that it is still a very valuable and worthwhile procedure for the treatment of benign peptic ulcer requiring surgery.

The study suggests that the postgastrectomy syndrome might be better prevented by intensive medical follow-up of resected patients for a period of six months to one year.

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We recommend:

Methodology of the Study of Ageing (Volume 3). Editors for the Ciba Foundation: G. E. W. Wolstenholme, O.B.E., M.A., M.B., B.CH. and Cecilia M. O'Connor, B.SC. 202 pages, 47 illustrations with references and a subject index. Twenty-seven participants. Boston, 1957. Little, Brown & Co. *Price* $6.50.

An Atlas of Cardiac Surgery. Prepared by Jorge A. Rodriguez, M.D., Assistant Professor of Surgical Anatomy and Research Associate, Department of Surgery, University of Mississippi Medical School. 250 pages, profusely illustrated, with an index. Philadelphia, 1957. W. B. Saunders Co. *Price* $18.00. (This outstanding work is divided into six sections: (1) surgical anatomy of the heart and great vessels; (2) adjuvants to cardiac surgery; (3) surgery of the great vessels; (4) surgery of the valves of the heart; (5) surgery of congenital defects of the heart; (6) pericardiectomy; revascularization procedures; wounds of the heart; cardiac arrest. The text occupies the left hand pages and beautiful line drawings occupy the right hand pages.)

Surgical Technique and Principles of Operative Surgery. By A. V. Partipilo, M.D., F.A.C.S., Clinical Professor of Surgery, The Stritch School of Medicine of Loyola University. Foreword by Alton Oschsner, M.D., F.A.C.S. Eighteen contributors. Sixth edition, thoroughly revised; 966 pages, 719 figures containing 1,235 illustrations, 4 in color, with references and an index. Original illustrations by W. C. Shepard and Hooker Goodwin. Philadelphia, 1957. Lea & Febiger. *Price* $20.00. (There are 8 new chapters on surgery of the neck, 9 new chapters on surgery of the heart and 9 new chapters on surgery of the chest; questionnaires at the end of most chapters. A functional book that presents the detailed surgical technics of virtually every operative procedure one may have occasion to use. A most satisfactory work.)

Improper Reduction of Fractures of the Proximal Phalanges of Fingers

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ONE of the most crippling fractures of a digit is the improperly reduced fracture of a proximal phalanx. Oblique fractures of this type are notorious in this respect because of the extreme difficulty in maintaining proper alignment of the fragments. These fractures are not only difficult to reduce but a greater obstacle is adequate maintenance of the reduced fragments in their correct position. The comminuted type of fracture must be maintained in excellent alignment over a period of several weeks or even months.

Any marked degree of malalignment of fractured segments results in such crippling deformity and limitation of motion that frequently corrective osteotomy must be performed. There then results prolonged postoperative care and, of course, great economic loss.

Marked angulation of fractured segments at the level of the proximal phalanx accentuates and greatly magnifies limitation of motion because of its proximity to the fulcrum or "cam-action" of the metacarpophalangeal joint. Deformities in this area include overlapping, torsion deformities, and flexion in the wrong plane. We must remember, as Sutro [*1*] has so well described, that there is a passive rotary motion in the metacarpophalangeal joint of each finger in amounts of 15 to 35 degrees, the greatest range being in the index and little fingers. Rotation deformities should be guarded against the fingers in the flexed position or position of function.

The usual deformity is palmar angulation of the proximal segment secondary to the pull or traction on it by the interosseous and lumbrical muscles. The distal fragment is then displaced dorsally. This deformity, therefore, is maintained and/or usually exaggerated when a throat stick splint is applied to the injured digit fully extended. Therefore, this type of fracture must never be treated with a throat stick splint.

The proper treatment is the application of a curved splint or roller bandage for a period of three to four weeks with the digit in "position of function." In the event of oblique fractures, traction over or against a molded splint must be maintained with the direction of pull opposite the tubercle of the scaphoid bone at the wrist. In this manner, traction with countertraction is constantly maintained. Slipping of oblique fractures and malalignment of comminuted fractures should be guarded against by frequent check-up roentgenographs. As Curry [*2*] so aptly states, "the underlying principle in all finger fractures is to match the mobile distal segment (or fragment) to the less mobile proximal one." After reduction, frequent circulation observations relative to color and temperature are of paramount importance when constant traction is used and, of course, traction must be discontinued at once if there is impairment of circulation.

If muscle balance cannot be maintained by closed reduction and traction, one should not hesitate to carry out open reduction and stabilization of the fracture with a fine Kirschner wire. Tendons should not be disturbed with such a repair and the resultant earlier motion shortens the usual postoperative course. This type of repair is especially suitable to fractures with displacement because of the possibility of interposition of soft parts.

It must be remembered that fractures of proximal phalanges always involve the flexor tendon tunnel and exacting alignment is essential to ensure a good result. Furthermore, bone spicules frequently tear the surrounding soft tissue.

The corrective type of osteotomy that must

FIG. 1. Before reduction.

FIG. 2. Before reduction.

necessarily follow this type of fracture when malaligned markedly prolongs total disability.

A minimum of eight weeks are required for bony union following corrective osteotomy and several more weeks or even months of physiotherapy to restore a full range of motion and to allow the patient to make a good grip or fist.

The basis for this report consists of six patients who were originally treated by the application of throat stick splints to poorly aligned fractures of proximal phalanges. The following two case reports are typical and, of course, demanded corrective osteotomy with its attendant prolonged economic loss.

CASE REPORTS

CASE 1. J. L., a twenty-eight year old Negro man, sustained a fracture of the right long finger with deformity of the proximal phalanx of same when some lead struck his right hand at his place of employment.

Unfortunately, treatment consisted of application of a throat stick splint with resultant marked malalignment of the fracture. (Figs. 1 and 2.) He was unable to approximate the tip of this finger closer than three inches to the palm of his hand. After a period of eight weeks had elapsed, I was called into consultation and advised corrective osteotomy. The following is a summary of the operative report:

Under adequate pentothal® anesthesia and with the patient in the dorsorecumbent position, with a tourniquet about the right upper arm and elevated to 300 ml. of mercury, the right hand was prepared with ether and zephiran® and properly draped, as was the right wrist. A bayonet type incision was made over the base of the dorsum of the right long finger and the incision was carried down through all layers to the extensor tendon, which was freed up and carefully retracted lateralward. Making use of a periosteal eleva-

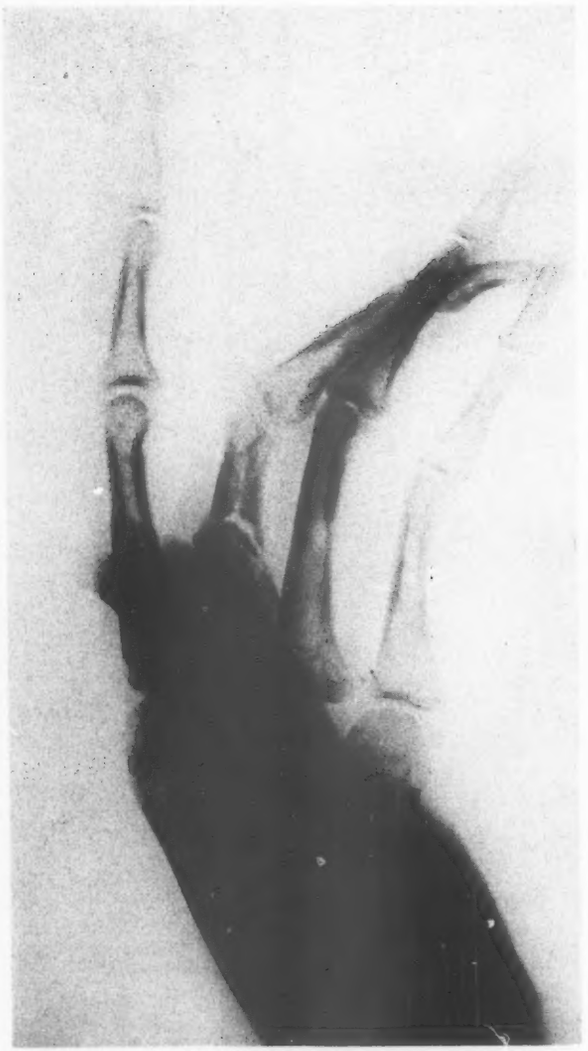

FIG. 3. Postreduction (corrective osteotomy) film.

tor, the periosteum in the region of the healed fracture was freed up, after which there could be easily identified the site of malalignment. Making use of a chisel and mallet, the fractured segment was divided at the site of the previous fracture, following which the medullary canals of both fragments of the phalanx were freed up with a curet. After the fragments had been well aligned (Fig. 3), they were held in place with a Kirschner wire, making sure that the wire was inserted in an oblique direction to avoid the joint surfaces. The skin edges were then approximated with interrupted black silk sutures, and a dry sterile dressing applied as well as a plaster cast, with the hand in position of function. The patient was returned to the ward in good condition.

Fourteen weeks after extensive physiotherapy, which included whirlpool and rubber ball exercises, he returned to his former work. He now makes an excellent fist.

CASE II. On May 15, 1953, a thirty-three year old man slipped while working and fell on some oil-covered steel plates. He injured the muscles of his right shoulder and his anterior chest wall, as well as fracturing his left index finger. He stated that as a result of an old injury, the distal phalanx of the left index finger had been previously amputated. X-rays taken at this time revealed a fracture of the midphalanx of the left index finger with poor alignment. A throat stick splint was applied to the injured digit and the patient continued to work. Repeat x-rays one month later demonstrated that the fragments of the finger were in marked malalignment. (Figs. 4 and 5.)

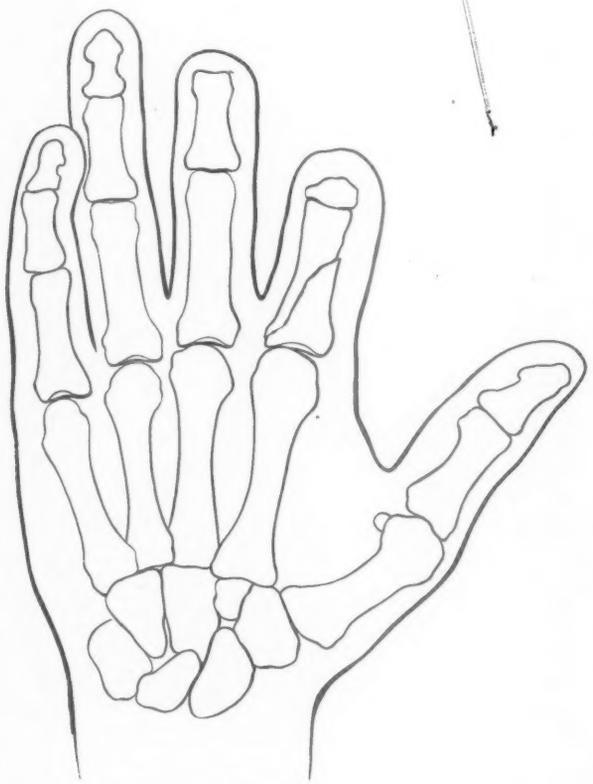

FIG. 4. Before open reduction. Exact duplication of x-ray (anterior-posterior view by artist.)

The patient complained of inability to flex his left index finger and he was referred to me. Regional physical examination revealed that the left index finger could not be flexed beyond an angle of 60 degrees at the metacarpopha-

langeal joint. The distal phalanx of the same finger was absent except for a small fragment. It was apparent from subsequent x-rays that the oblique type of fracture which was originally present had not healed properly and that the two fragments of bone were in poor apposition. The patient was advised to enter the hospital for corrective osteotomy and realignment of the fracture. On June 9, 1953, surgery was carried out as follows:

Under adequate pentothal anesthesia and with a tourniquet about the left upper arm and elevated to 300 ml. of mercury, the left hand was prepared with ether and zephiran and then draped with a sterile stockinet, towels and sterile sheeting. The left index finger was brought out through the stockinet. Over the mid-lateral radial aspect of the left index finger, and in vertical fashion along the proximal phalanx, an incision was made down to the periosteum, which was then elevated with a periosteal elevator. Through the use of a chisel and periosteal elevator, the fragments were then separated and the medullary canals of both fragments were freed up of callus. The bone fragments were realigned (Fig. 6) and a short section of Kirschner wire was placed in oblique fashion through the two fragments, holding them in exact alignment. The skin edges were approximated with interrupted vertical mattress black silk sutures. Then with the finger flexed in position of function, a vaseline gauze dressing, as well as sheet wadding and plaster cast, was applied.

FIG. 5. Drawing of lateral view of x-ray. Note marked malalignment of fracture.

FIG. 6. Following corrective osteotomy. Note perfect alignment of fracture.

Follow-up x-rays were taken and revealed excellent alignment of the bone. Thus the patient was enabled to achieve a complete fist, whereas this had been previously impossible, due to the malunited proximal phalanx of the index finger. However, correction of this deformity required a total of five months' time, a deformity which could have been entirely avoided.

SUMMARY

1. Position of function (or rest) is essential to maintain proper balance between antagonists and protagonists in the treatment of fractured proximal phalanges.

2. Exacting alignment of fractured segments is essential to prevent tendons from being fixed in callous formation as the floor of the phalanx is, in effect, the seat of the tendon sheath and naturally provides the gliding mechanism for the tendon.

3. A mere 15 degrees of dorsal angulation in a proximal phalanx fracture will be so accentuated or magnified as to prevent the finger tip from touching the palm of the hand.

4. Exacting and correct primary treatment of these fractures will avoid secondary (corrective osteotomy) procedures, thereby greatly benefiting the injured employee in time, wages and in his mental outlook.

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Lipoma of Sigmoid

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FOR many years surgeons have been interested in benign tumors of the large bowel because of their symptomatology, difficulty in diagnosis and the good prognosis after resection.

Submucous lipomas have been found all along the gastrointestinal tract. The colon has the highest incidence of submucous lipomas, and here they sometimes become bulky and cause obstruction. Of the benign tumors of the intestinal tract, lipomas are second in frequency to adenomatous polyps.

Bauer [*1*] in 1757 was the first to record accounts of lipomas of the gastrointestinal tract. Hiller [*2*] in 1829 studied a series of twenty-three cases, and since that time there have been numerous reports in the literature.

In 1909 Stetten [*3*] cited seventy-two cases of lipomas of the gastrointestinal tract, in thirty-two of which the lesions were in the colon. In 1931 Comfort [*4*] presented twenty-eight additional cases, making a total of 181 up to that time. Ninety-two lipomas were in the colon, sixty-five in the small bowel and twenty-four in the stomach.

In 1934 Poston [*5*] brought the total number of cases to 242, while Schottenfeld [*6*] in 1943 added six cases of his own, increasing the total number of reported clinical and necropsy cases to 275; of these, 121 were cases of lipoma of the colon.

Incidence. Several noteworthy contributions have been made with regard to the colon itself. Pemberton and McCormack [*7*] analyzed ninety-seven clinical cases in which symptoms had been produced by the tumor. They stated that "excluding adenomatous polyps, lipomas are the most common tumors of the G. I. tract." Gault and Kaplan [*8*] presented fourteen instances of colonic lipoma and stated: "Benign tumors of the colon are comparatively rare. Of these, lipoma is the second most common tumor." In 1944 Browne and McHardy [*9*] reported five examples of their own and listed 130 from the English literature. In 1946 Runyeon [*10*] added two cases and reviewed 121 satisfactorily studied clinical cases, while Pack and Booker [*11*] one year later gathered 153 cases of submucous lipoma of the large intestine from the literature and contributed two of their own. Long, Dockerty and Waugh [*12*] found thirty-three instances of lipoma of the large bowel in a survey of 125,000 laparotomies, and stated that since these were all clinical cases their survey probably represented a concise account of the actual frequency of these tumors in surgical practice. In 1949 Mayo and Griess [*13*] reported nineteen cases, bringing to forty-three the number of operations performed for this condition. Comfort found that in a study of 3,924 necropsies the incidence of lipoma of the colon was 0.5 per cent, while Kirschbaum [*14*] detected an incidence of 0.2 per cent in 5,724 clinical examinations, indicating that many lipomas may be silent. Comparing this percentage to data on adenomas, Saint [*15*] discovered only two lipomas in contrast to thirty-six adenomatous polyps in a series of forty-four benign polypoid lesions of the colon.

Location. Studies have indicated that lipomas are more frequent in the colon than anywhere else in the gastrointestinal tract. With regard to the different portions of the large intestine involved, in order of frequency, these tumors are found in the cecum, the ascending colon and the sigmoid, about 50 per cent occurring in the right half of the colon [*16*]. Boyd [*17*] stated that the predominant ileocecal frequency is due to the local inflammation and irritation so common in this region. Pemberton and McCormack, in 102 cases, observed twenty-nine lipomas in the cecum, twenty-one in the ascending colon, fifteen in the transverse colon, fourteen in the sigmoid, twelve in the rectum and eleven in the descending colon. Runyeon, in 109 instances in which definite localization

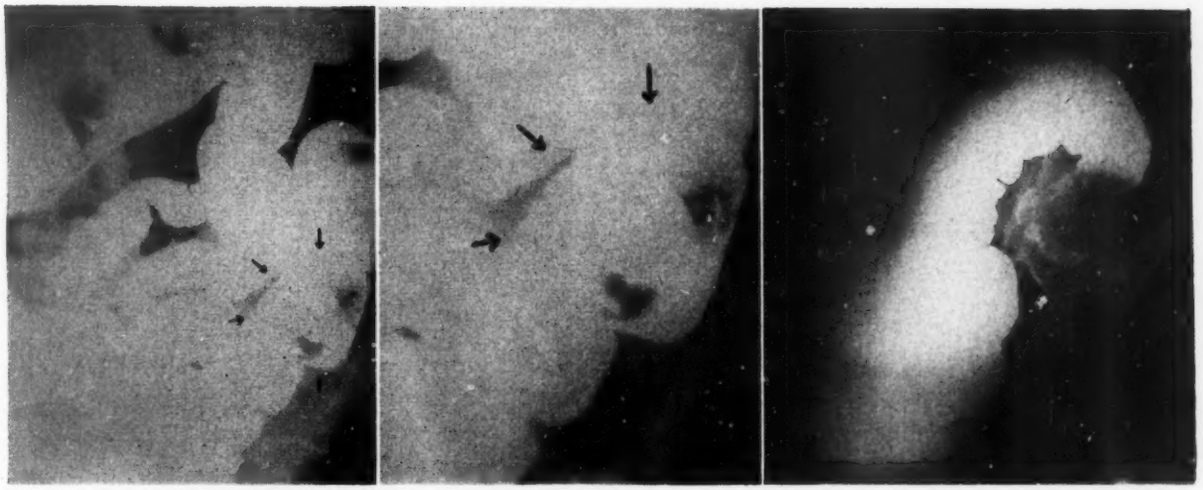
was possible, found fifty-one or 46 per cent in the cecum and ascending colon, an approximate length of 25 cm., and forty-one or 38 per cent in the left half of the colon, a distance of 85 cm. This study shows lipoma of the right half of the colon to have a relative incidence of six times that of the same tumor in the transverse portion of the colon and four times its incidence in the left half. A private communication with the Armed Forces Institute of Pathology [18] revealed that nine lipomas have been recorded as occurring in the sigmoid colon and forty-four lipomas as occurring throughout the remainder of the colon.

Pathogenesis. The etiologic background of intestinal lipoma is still unsettled. As has been mentioned, Boyd stated that inflammation and irritation may play a role, especially in the ileocecal region. Other theories have been advanced. Minelli [19] expressed the opinion that these tumors are the result of degenerated connective tissue, while Cicala [20] suggested that they arise as a result of perivascular infiltration in the fibrous trabeculae. On the other hand, Alveoli [21] concluded that a deposit of fatty tissue results from maldevelopment in the lymphatic supply and muscular circulation of the tissues, whereas Borst [22] considered lipomas the consequence of metaplasia of connective tissue into the adipose variety. Geschickter [23] stresses the association of lipoid tissue with the distribution of many solitary lipomas in the interscapular region corresponds to a peculiar mass observed in the embryo, composed of vascular lymphoid tissue, and containing many fat cells. In other regions of the body this same association apparently occurs, and Geschickter concluded that lipomatous tumors in general probably follow the same distribution as lymphatic cysts. He further stated that both lymphoid and lipomatous tissue develop late in the course of evolution and late in embryonic life, the transformation from connective tissue to xantholipoma to fat occurring after the sixth month and being very active just before birth. In addition, he expressed the opinion that the further development of fat in later life is under hormonal influence, which variable but probably derived from more than one source, the chief of which are the anterior lobe of the pituitary gland, the sex glands of internal secretion and a related chorionic hormonal substance, prolan, present in the urine during pregnancy. Concerning the pathogenesis of these tumors, Long and his co-workers stated there is good evidence that adipose tissue is not merely connective tissue containing fat but is a part of the reticuloendothelial system and is a specialized organ. They pointed out, as others have done, that lipomas appear to spring from deposits of adipose connective tissue in the submucous and subserous zones of the colon.

Pathologic Picture. Histologically, lipomas are well differentiated benign tumors composed of adult fat cells enclosed in a capsule. In the colon they are of two types, submucous (90 per cent) and subserous (1 per cent). They usually occur singly but may be multiple, and the two kinds may be found together. Comfort observed seven cases of combined lesions and thirteen of multiple tumors, the latter as a rule being of the submucosal variety. The subserosal tumors generally arise from the appendices epiploicae and may attain huge proportions before it produces symptoms. The submucosal kind, on the other hand, arise when a cluster of fat cells or a minute lipoma herniates along with the submucosa into an infolding of the mucosa. They may be sessile or pedunculated and vary in size from a microscopic collection of fat cells to large polyps. However, this variety rarely attains a large size because of the symptoms produced by obstruction to the lumen. Comfort found that the symptomatic tumors averaged about 8 cm. in diameter. Pedunculated growths are the result of peristalsis and the irritation of the passing intestinal content, and the well developed ones are covered by a thin atrophic mucosa with a barely perceptible muscularis mucosae.

Complications and Symptoms. Submucosal lipomas commonly produce complications, the chief of which are irregular and forceful peristalsis, obstruction, ulceration and intussusception. They may undergo spontaneous expulsion or circulatory changes resulting in edema, hemorrhage, cystic degeneration, necrosis, ulceration or sloughing. Comfort, and Pemberton and McCormack reported a 50 per cent incidence of intussusception. Manheim and Peskin [24] observed twenty cases of spontaneous expulsion of intestinal lipomas. The subserous variety, on the other hand, produces complications by direct compression or, if pedunculated, by traction on the pedicle.

The symptoms of colonic lipomas are variable and there is no specific clinical picture. The

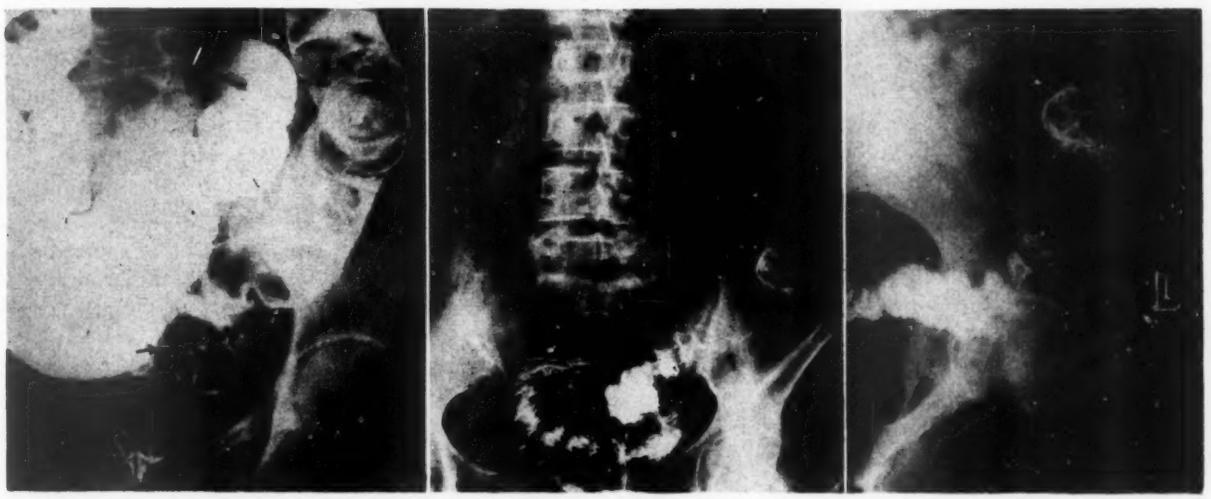


1 2 3

FIG. 1. Barium introduced into the colon showing complete filling and a lesion at the junction of the descending and sigmoid colon.

FIG. 2. Oblique view of the area involved, further showing an ovoid defect.

FIG 3. Spot film showing a large defect in the upper sigmoid.



4 5 6

FIG. 4. Evacuation film further reveals the ovoid, non-opaque filling defect involving the entire lumen of the upper sigmoid.

FIG. 5. Another evacuation view in the anterior-posterior position, again showing the ovoid defect in the upper sigmoid colon.

FIG. 6. Oblique view clearly shows the ovoid lesion on spot evacuation film.

size, location and behavior of the tumor determine the time of onset of the symptoms, which are secondary to the complications mentioned heretofore, i.e., disordered peristalsis, obstruction, intussusception, ulceration and circulatory injury. The symptoms therefore are simply those encountered in the presence of any colonic tumor, benign or malignant. Browne and McHardy recorded an incidence of pain in 75.2 per cent of cases, a palpable tumor in 74.2 per cent, constipation in 55.4 per cent, weight loss in 14.6 per cent and bleeding sufficient to produce anemia in 7.9 per cent. However, the profound anemia associated with carcinoma of the cecum has not been observed. Diarrhea or constipation alternating with diarrhea may occur. With regard to location, Comfort detected symptoms in 75 per cent of

FIG. 7A. Gross, unopened specimen of sigmoid measuring 8 by 6 cm.

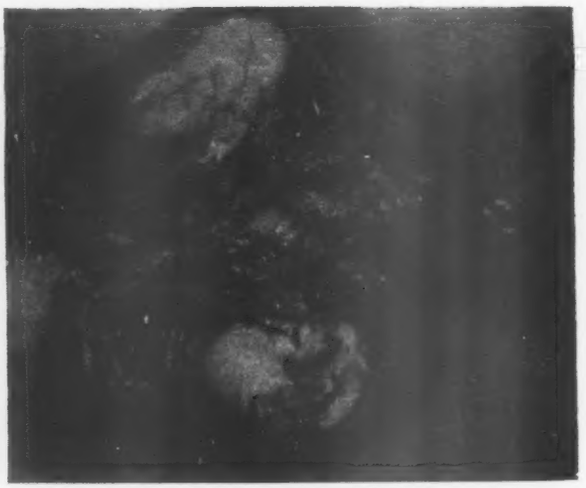


FIG. 7B. Sigmoid sectioned longitudinally shows a growth arising from a small part of its wall.

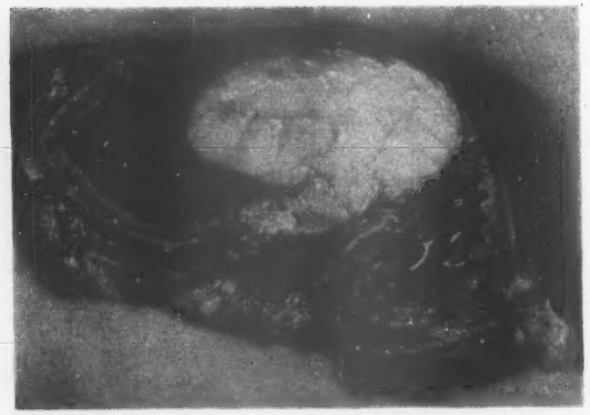


FIG. 8. Growth *in situ* measuring 6 cm. in length and 5 cm. in diameter, consisting of adipose tissue.

cecal lesions, 79 per cent of those in the ascending colon and 90 per cent of those occurring in the transverse and sigmoid portions of the colon.

CASE REPORT

M. C., a fifty-eight year old white woman, was admitted to the hospital on December 26, 1956, complaining of pain in the left lower quadrant of the abdomen and diarrhea.

Onset of symptoms was six months previously, when crampy abdominal pain developed in the left lower quadrant, associated with diarrhea. Pain was intermittent, occurring two to three days a week. The stools were streaked with bright red blood and were watery in character. There was considerable rectal tenesmus. At intervals of about ten days she had solid stools which were mixed with stringy mucus. She had been treated by several doctors for "mucous colitis," but to no avail.

Two weeks before admission to the hospital the patient had had ten to twelve watery bowel movements per day, which were tinged with bright red blood and had mucus but no pus. There was no nausea or vomiting.

Systemic review was not informative. The patient had lost 30 pounds in the past two months. Her husband and children (three) were living and well.

Physical examination revealed normal findings except for an obvious loss of weight. The blood pressure was 160/80. There was no enlargement of viscera and no definite masses palpable. Slight tenderness was elicited in the left lower quadrant of the abdomen. Rectal and vaginal examinations were negative.

Laboratory studies showed a hemoglobin level 13.5 gm. per cent, an erythrocyte count of 4,020,000 per cu. mm. and an index of 1.0. Urinalysis and blood serology were negative. Blood sugar two hours postprandial was 124 mg. per cent. There was a slight increase in the sedimentation rate. Blood urea nitrogen was 11.6 mg. per cent, cholesterol 236 mg. per cent, serum bilirubin 0.35 mg. per cent and serum lipase 0.38 cc. No ova or parasites were found on stool examination, and there was a moderately positive reaction for occult blood. An electrocardiogram showed evidence of an old posterior myocardial injury.

Proctosigmoidoscopic investigation was performed and the sigmoidoscope was passed for 6½ inches, with negative findings; however,

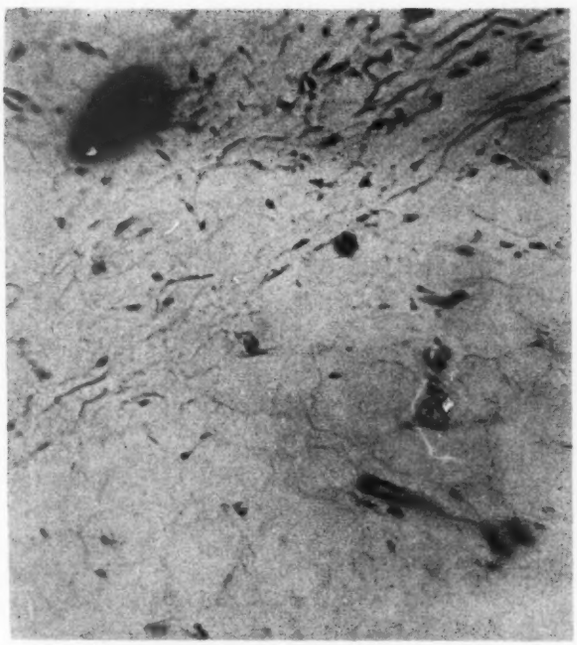


FIG. 9. Photomicrograph shows the growth to be composed of adult fat cells.

FIG. 10. Tumor arising from the submucosa of the bowel wall.

beyond this point a rather sharp angle was encountered, so that even with air insufflation it was impossible to pass the scope beyond this point.

A barium enema x-ray study revealed no difficulty in introducing the clysma, and a marked redundancy of the entire colon with escape of barium into the terminal ileum was seen. (Figs. 1 and 2.) A spot film showed a large filling defect in the upper sigmoid. (Fig. 3.) Evacuation film revealed an ovoid, non-opaque filling defect occupying the entire lumen of the upper sigmoid colon, demonstrated on multiple films and multiple projections. (Figs. 4 to 6.)

In view of the x-ray findings in the upper sigmoid, loss of weight and blood in the stools, malignancy was considered and the patient was prepared for surgery. Castor oil, 1½ ounces, was given immediately, as well as daily enemas. Sulfasuxidine® was administered three days prior to surgery, and neomycin® twenty-four hours before operation.

The patient was operated upon with a preoperative diagnosis of polypoid lesion of the upper sigmoid, probably malignant. The abdomen was opened through a lower left rectus incision and a soft, freely movable mass about the size of a large lemon was palpated in the upper end of the sigmoid colon. It appeared to be attached beneath the mucosa and could be moved proximally and distally for a distance of several inches. There were four large lymph nodes in the mesentery, which were resected with the sigmoid containing the lesion, going well beyond it on either side. There were no aortic nodes, and exploration of the liver and the rest of the abdomen was negative.

An end-to-end anastomosis was performed between the descending colon and the lower end of the sigmoid. The abdomen was closed with a cigarette drain in the left pelvis, which was brought out through the lower third of the incision.

The pathologic report was as follows: Grossly, the sigmoid measured 8 by 6 cm. The specimen felt solid, as if the cavity were occupied by a growth. (Fig. 7A.) On sectioning the wall of the sigmoid longitudinally a growth was found which arose from a small part of its wall. (Fig. 7B.) This growth was oval, rounded out at the poles and measured 6 cm. in length and 5 cm. in diameter. Grossly it seemed to consist of adipose tissue covered by a tissue which was harder than the fat and slightly brownish in color. (Fig. 8.) This tumor must have pressed intensely on the wall of the sigmoid, judging from the fact that a part of the sigmoid where this was lying was devoid of the rugae, while they were still present above and below this tumor.

Microscopically, a section of the polypoid growth revealed it to be composed of adult fat cells basically, and including small arterioles

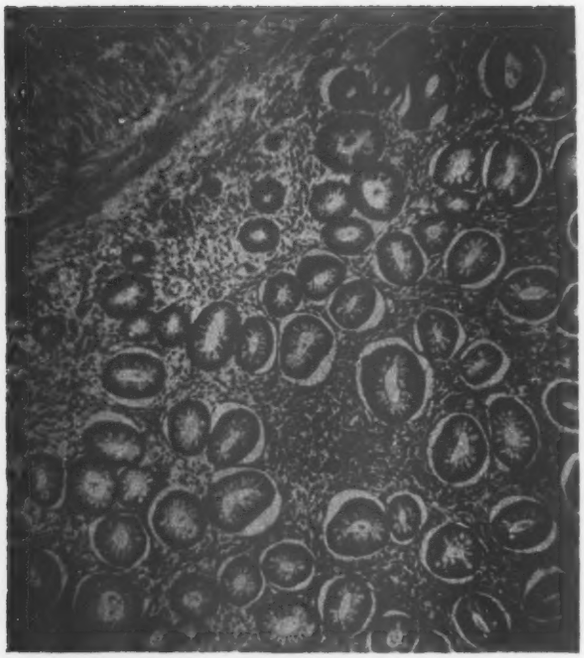


FIG. 11. Microscopic section showing intact bordering mucosa.

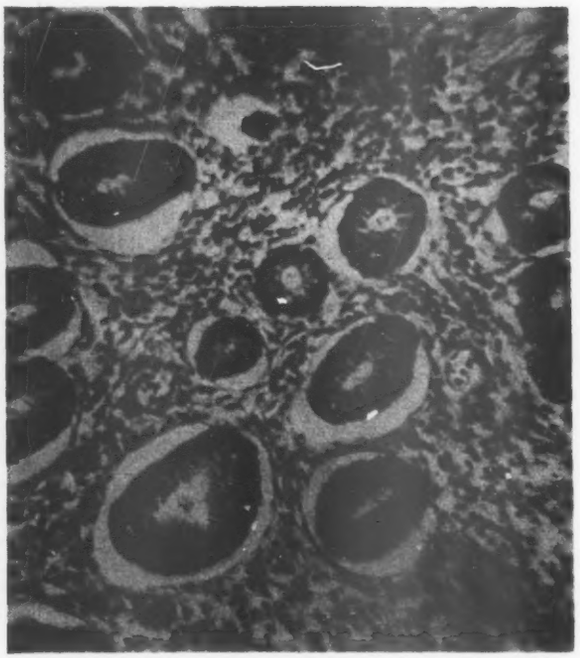


FIG. 12. Photomicrograph shows the mucosal cells are regular and no evidence of malignancy.

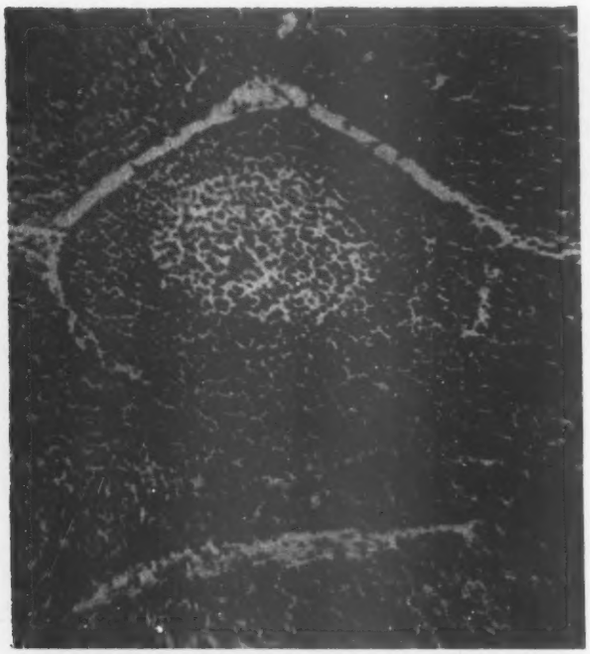


FIG. 13. Section of lymph nodes in mesosigmoid reveals regular architecture throughout.

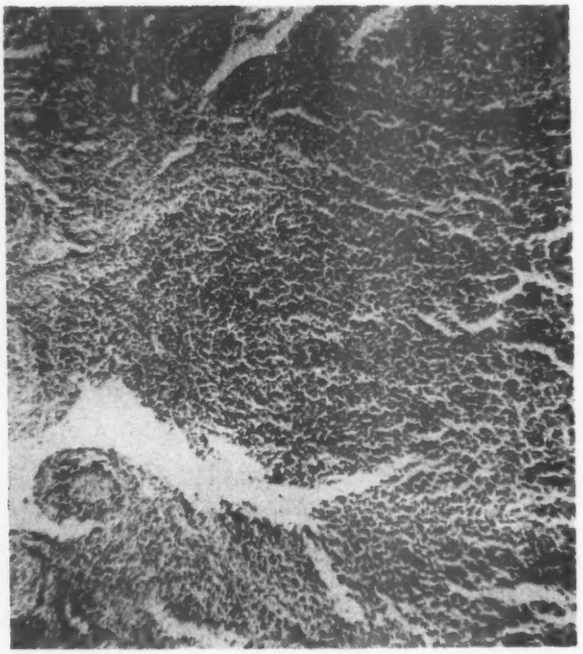


FIG. 14. Further views of lymph nodes showing no disturbance of pattern or malignancy.

and fibrous tissue septa. (Fig. 9.) The luminal margin revealed an inflammatory exudate composed of fibrin and neutrophils. The mucosal epithelium was absent. The tumor arose from the submucosa of the bowel wall, the bordering mucosa of which was intact and the cells regular. (Figs. 10 and 11.) The muscularis and serosa were normal although eosinophilic neutrophils and small round cells were scattered diffusely throughout. (Fig. 12.) Lymph nodes (four) from the adjacent area were regular in architectural pattern. (Figs. 13 and 14.)

The diagnosis was: lipoma of the sigmoid colon.

The patient made an excellent recovery postoperatively and was discharged on the ninth postoperative day. Subsequent follow-up showed the wound to be well healed. When last seen the patient felt excellent and had gained 7 pounds. Bowel action was normal and she was performing light household duties.

SUMMARY AND CONCLUSIONS

1. The historic, etiologic, pathologic, and symptomatologic aspects of colonic lipomas are discussed.

2. Lipoma of the large intestine is second in frequency, in benign lesions, only to adenoma and should be considered in the differential diagnosis of tumors involving the colon.

3. A case of lipoma of the proximal sigmoid colon is reported, in which resection was performed with complete recovery.

4. Lipomas occur most often in the cecum and ascending colon, and may simulate carcinoma; however, these lesions seldom occur in the sigmoid. In the case presented herein there was clinical evidence of weight loss, diarrhea with streaks of bright red blood and x-ray evidence of a filling defect causing partial obstruction of the bowel which made one suspicious of malignancy.

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Povidone-Iodine As a Topical Antiseptic

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POVIDONE-IODINE is an iodine complex, known more commonly as PVP-iodine (PVP-I). Povidone (PVP; polyvinylpyrrolidone) itself, a water-soluble polymer physiologically acceptable to both human beings and lower animals, is capable of combining with iodine and thereby making it soluble. This strong complex action of iodine by PVP, which results in the production of the chemically stable PVP-I, yields a finished product in which approximately two-thirds of the original amount of iodine complex is still present as available iodine, an effective and active form of iodine useful for microbiocidal purposes. The remainder of the iodine is present essentially as an inorganic iodide ion and a very small amount is organically combined. These two latter forms do not yield available iodine.

In addition to the iodine becoming soluble, other properties are changed and improved by the complex action. The iodine vapor pressure is reduced, depending on the proportion of PVP and iodine employed. This results in the availability of more stable solutions of active iodine when using solutions of PVP-I. The most common ratio of iodine to PVP employed in making satisfactory solutions is one containing 10 gm. of available iodine per 100 gm. of PVP. This powder, known as PVP-I [*10*] and given the generic name povidone-iodine [*10*], contains approximately 85 per cent PVP, 10 per cent available iodine and 5 per cent iodide ion. A 10 per cent aqueous solution of povidone-iodine, containing 1 per cent free iodine, is available.†

Povidone-iodine has all the advantages of free iodine, including its effective microbiocidal activity, and in addition has other valuable characteristics. It does not stain as does iodine tincture U.S.P. or iodine solution N.F. However, solutions of PVP-I retain a visible color to delineate the area treated, but this color can be removed instantly by wiping or washing with water. Povidone-iodine rarely irritates the skin, mucous membranes or exposed surfaces, and the toxicity of the iodine is reduced [*1*].

Iodine as a tincture was used on wounds in 1839, and during the American Civil War it was employed on battle wounds. It is especially looked upon with favor because of its rapid microbiocidal action under varying adverse conditions, this efficiency extending to most bacteria, fungi, viruses, rickettsia and protozoa.

Hare [*2*] and Ogilvie [*5*] have noted the effectiveness of iodine as a skin antiseptic. Zintel [*3*], in reporting on the evaluation of various preparations and technics including hexachlorophene, merthiolate,® zephiran® and alcohol, considered iodine the most effective agent used. Scurr [*4*] advocated treating the skin with this agent before giving an injection. The use of iodine for sterilizing catgut and as an agent to prevent and treat infections has been detailed in the literature [*6–9*]. Povidone-iodine can be used here as the iodine preparation of choice, as it produces "the antimicrobial effects of iodine in general" [*10*].

EXPERIMENTS

Test Bacteria. The test bacteria were Micrococcus pyogenes var. aureus F.D.A. 209, A.T.C.C. No. 6538; Salmonella typhosa, Hopkins strain (Zoph) Weldin, F.D.A., A.T.C.C. No. 6539. The following were isolated from pathologic processes: Micrococcus pyogenes var. aureus (resistant to penicillin, aureomycin,® terramycin,® tetracycline, neomycin,®

† Betadine,® (brand of polyvinyl-pyrrolidone (povidone)—iodine complex) antiseptic, distributed by Tailby-Nason Co., Inc., Dover, Del.

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chloromycetin® and sigmamycin®), another strain of Sal. typhosa, Streptococcus hemolyticus (two different strains) and Pseudomonas aeruginosa (two different strains).

Temperature. All tests were conducted separately at 20°c. and at 37°c.

Samples Tested. Aqueous solutions of povidone-iodine, containing 1 per cent free iodine, were tested.

Culture Media. Formulas are given in "Official Methods of Analysis, Phenol Coefficient Method" [*11*].

TECHNICS

1. Five milliliters of the antiseptic and *5* ml. of dilutions thereof (1:2; 1:4; 1:6; 1:8 and 1:10) were placed separately in sterile tubes in a water bath adjusted to the designated temperature. An inoculum (0.*5* ml.) of a twenty-four hour old culture of the test organism, separately in each instance, was added to each tube containing the antiseptic or a dilution of the latter. At time intervals of fifteen, thirty and forty-five seconds, and one, two, three, four, five, ten and fifteen minutes, one standard loopful [*11*] of the antiseptic-bacteria mixture was transplanted separately into 10 ml. F.D.A. broth containing 1 per cent sodium thiosulfate. Duplicate tests were also conducted in which thioglycollate broth U.S.P. was employed in the tests with Str. hemolyticus. Controls were run in which no antiseptic was present. All transplants were incubated at 37°c. for at least four days before final readings were made. (2) The foregoing technic was repeated but modified in that the inoculum consisted of human blood serum containing the test bacteria. The amount added yielded an antiseptic mixture containing *5* per cent human blood serum and 0.*5* ml. of the test organism. (3) The technic as described in (2) was repeated but modified in that the inoculum consisted of citrated whole human blood. The final mixture contained 10 per cent citrated whole human blood and 0.*5* ml. of the test organism.

All tests were checked and rechecked.

Findings. In all instances povidone-iodine, even in dilutions up to and including the 1:10 dilution, without and with whole human blood or blood serum, killed separately on contact and within fifteen seconds the bacteria in a 4 mm. loopful, respectively, of the test bacteria employed.

SUMMARY AND CONCLUSOINS

Povidone-iodine (PVP-I), as the iodine preparation of choice and as an antiseptic for the skin and mucous membranes, possesses all the effective microbiocidal activity of free iodine. It rarely irritates the skin, mucous membranes or exposed surfaces, and the toxicity of iodine is reduced. Solutions of PVP-I retain a visible color to delineate the area treated, but this can be removed instantly by wiping or washing with water.

In the study reported herein the bactericidal efficiency of PVP-I, even in dilutions up to and including the 1:10 dilution without and with whole human blood (10 per cent) or blood serum (*5* per cent), was adequate to kill separately on contact, within fifteen seconds, the bacteria in a 4 mm. loopful inoculum of the following test organisms: M. pyogenes var. aureus, F.D.A. 209; Sal. typhosa, Hopkins strain; and the following organisms isolated from pathologic processes: M. pyogenes var. aureus (antibiotic resistant); two different strains, each of Str. hemolyticus and Ps. aeruginosa and another strain of Sal. typhosa. This includes both gram-negative and gram-positive bacteria.

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Osteoplastic Reconstruction in Severe Fractures of the Tibial Condyles

UTILIZATION OF THE ANTERIOR SUPERIOR ILIAC SPINE

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RESTORATION of a smooth articular surface in normal joint relationship—the essential principle of the treatment of any fracture involving a weight-bearing joint—is generally considered to be impossible in certain severely disorganized fractures of the tibial plateau. An unsolvable puzzle is encountered when portions of the tibial articular surface are minutely fragmented and depressed into the cancellous bone of the condyle. Stabilization of the tibial surface by elevating the depressed area and bracing it in position with bone grafts, which is a perfectly satisfactory method of treatment for many depressed fractures, is not feasible in the severely comminuted type.

It is surprising how little effort has been made to resolve the treatment of such fractures. In an extensive review of the literature, the only method uncovered was that of Wilson and Jacobs [*1*], in which the damaged tibial plateau is replaced with the articular surface of the patella.

In this article a reconstruction procedure is described which, as far as it has been possible to determine, is new. The method consists of replacing the destroyed articular surface of the tibia with the anterior superior iliac spine. This is a preliminary report, as the procedure has thus far been used in only two cases, but it seems justifiable in view of the good results obtained.

There is nothing new to add to the general understanding of the etiology, mechanism and diagnosis of the severe fracture of the tibial condyle. It is an uncommon injury. In my experience it was unusual to have encountered two such cases in a single year.

The prognosis is generally considered to be grave. Serious articular disturbance is manifested by pain, weakness and instability of the knee, restricted mobility of the joint and increasing deformity. The irregularities in the joint predispose to the eventual development of hypertrophic changes.

OPERATIVE METHOD

Indications. The two cases in which the method has been used were recent fractures of the lateral tibial condyle. The procedure would likewise be applicable to a similar type of fracture of the medial condyle. It might also be used in long-standing fractures.

Technic (*Fig. 1*). A short period of rest is advisable before the operation, in order to permit reabsorption of the extreme hematic effusion which invariably accompanies these fractures.

The knee area is prepared in the usual manner. The leg is flexed to the right angle and a tourniquet is applied to the upper thigh.

The joint is approached by a longitudinal incision anterior to the collateral ligament and following the curve of the flexed joint. The incision should be of sufficient length to provide for thorough inspection of the joint. Dissection

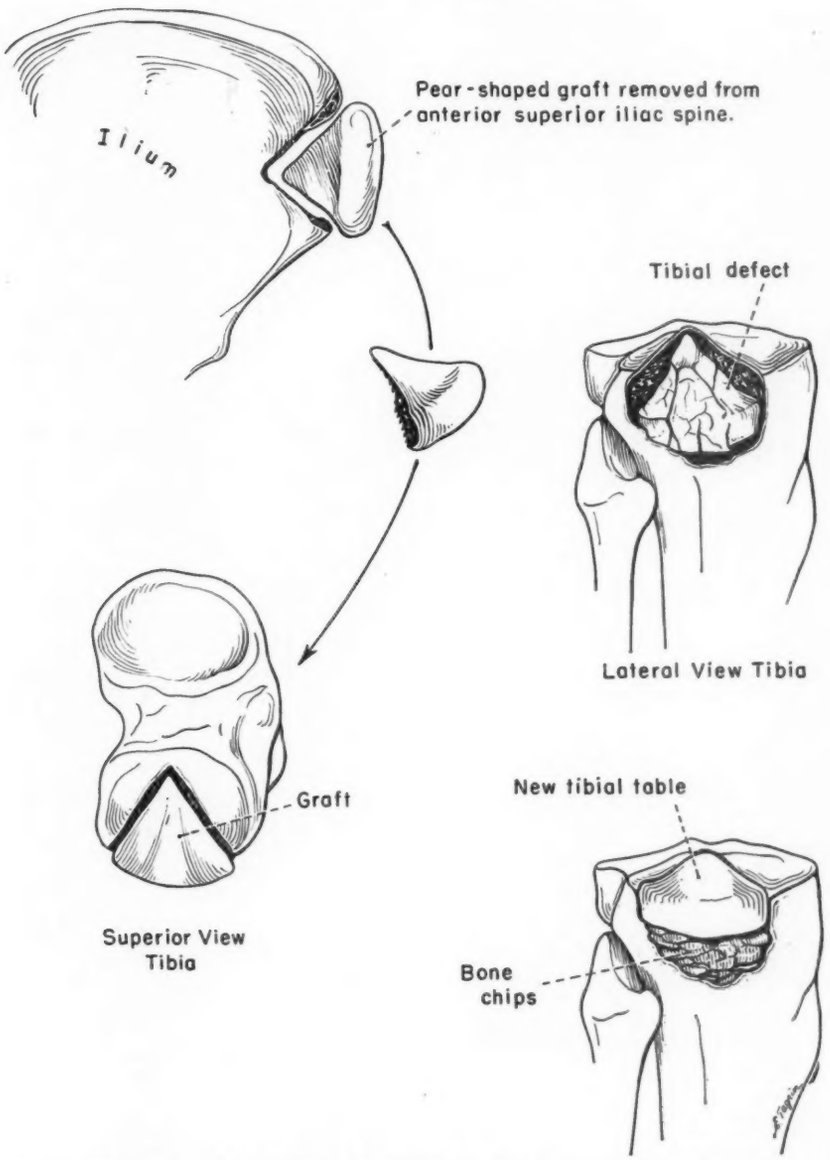

FIG. 1. Illustration of the steps in technic, showing the removal of the iliac spine graft and its insertion to replace the destroyed articular surface of the tibial condyle.

of the skin, heavy fascia lata and synovial membrane is made in layers.

Blood clots are evacuated from the joint. The meniscus on the injured side, which is always damaged, is removed. Any concomitant injury of the cruciate ligaments, collateral ligament, tibial spine and head of the fibula is noted.

The site of the fracture is carefully inspected. It is at once apparent that restoration of the depressed comminuted area to anatomic position is impossible. As a rule, some portions of the condylar plateau are observed to lie in approximately normal position in this type of fracture, and these portions indicate fairly accurately the true level of the articular surface.

The next step is to fill the defect in the tibial surface with an iliac bone graft. The anterior superior spine of the ilium is singularly adaptable for this purpose. Its inner concave surface is suitable in conformation to replace the tibial weight-bearing area. Moreover, it consists of cancellous bone, which is more readily incorporated than cortical bone.

The anterior superior iliac spine on the unin-

FIG. 2. Case 1. A comminuted depressed fracture of the posterior surface of the lateral tibial plateau. The anterior portion of the tibial surface remains at its normal level.

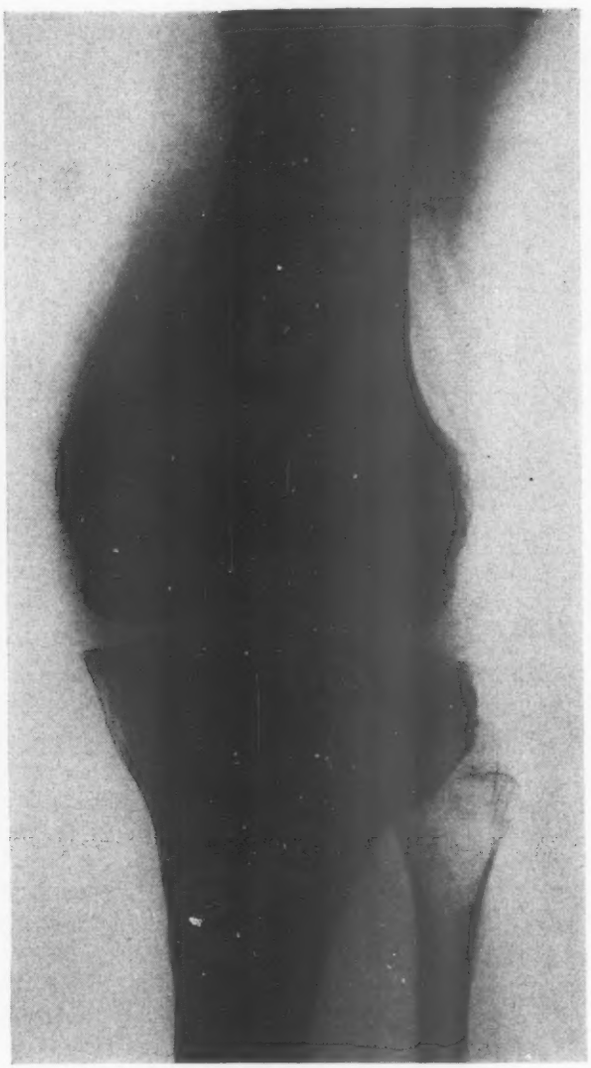

FIG. 3. Case 1. Roentgenogram taken two years and three months after the operation, showing the restored tibial plateau and the well incorporated graft.

jured side is denuded subperiosteally of its attachments, and a section of bone, sufficient in length and depth to fill the tibial defect, is removed. The bone graft is pear-shaped and includes the inner surface of the iliac spine, which will form the new upper tibial surface.

Prior to the insertion of the graft, any loose fragments of bone are scraped off the crushed tibial area. The graft itself is then shaped and sharpened so that it will fit under the inner section of the fractured tibial surface. After the graft has been seated in the tibial defect with its curved face upward, it is driven in to form a new tibial plateau. Front and back, the graft should lie slightly higher to allow for any settling. If required, bone chips may be used to shim up the newly formed tibial table. These may consist of fragments of cancellous bone removed from the ilium or of fragments that were discarded in the shaping of the graft.

The wound is closed in the usual manner. After a pressure dressing has been applied, the tourniquet is removed. A plaster cast is then applied, extending from the toes to the high groin, with the knee flexed approximately 5 degrees. In cases of reconstruction of the lateral tibial surface, the extremity is also placed in as much overcorrection in varus as possible in order to prevent undue pressure on the grafted area.

FIG. 4. Case 11. A depressed comminuted fracture of the central and anterior portions of the tibial plateau, with slight downward displacement of the remaining condylar surface.

FIG. 5. Case 11. Roentgenogram taken approximately one year and three months after surgery, showing the restored tibial plateau and incorporated graft.

Postoperative Care. Plaster immobilization is maintained for a period of from six to eight weeks. Promptly after the operation the patient is instructed in quadriceps contraction exercises. Walking with crutches may be authorized at any time during the period of plaster fixation, with the patient bearing weight on the opposite leg and merely touching the injured extremity to the floor for balance.

At the expiration of the period of immobilization the plaster cast is bivalved. The patient may then be ambulatory with crutches, wearing either the posterior shell or a walking caliper for protection of the extremity. Quadriceps exercises are increased, and gentle motion of the knee is begun.

The time when full weight bearing may be resumed will vary from two to four months after the operation, depending on how long it takes for consolidation to become complete. It must be emphasized that permanent weight bearing should not be hurried, because the bone involved is cancellous and because the leverage on the newly grafted tibial plateau is considerable when full weight is borne.

CASE REPORTS

CASE I. H. B., a fifty-seven year old housewife, sustained a fracture of the lateral tibial condyle on September 3, 1954, when she fell down stairs. Emergency treatment had consisted of immobilizing the extremity in a plaster cast.

The patient was first seen eleven days after the accident. The injured extremity, encased in plaster, was in valgus deformity of 20 degrees. Roentgenograms disclosed a comminuted fracture of the posterior weight-bearing surface of the tibial plateau. (Fig. 2.) The fragments were displaced and jammed down approximately 1 inch, which accounted for the pronounced knock-knee deformity when the extremity had been in the plaster cast. The anterior portion of the tibial table remained at the normal articular level.

The reconstruction operation was performed, replacing the depressed tibial surface with a bone graft consisting of the anterior superior iliac spine. On exposure of the joint, the lateral meniscus was found split in two in its mid-section at the site of the fracture line. An attempt was made to lift up the depressed posterior area of the condylar surface, with the result that it fragmented completely.

Within three months after the operation the patient was walking with crutches, bearing partial weight. The knee joint was stable and had a few degrees of motion.

A follow-up examination was made in December, 1956, two years and three months after the operation. The knee was pain-free and stable, with no abnormal lateral mobility. The range of motion in extension and flexion was complete. The patient was as active as before the injury and had resumed her household duties.

On a roentgenogram taken on December 18, 1956, at the time of the late follow-up, the iliac graft was seen to be well incorporated. (Fig. 3.)

CASE II. J. G., a seventy-five year old housewife, suffered a fracture of the lateral tibial condyle on the left side on September 27, 1955, when she fell on the ground. She was seen soon after the injury. A roentgenogram revealed a depressed comminuted fracture of the central and anterior portions of the outer tibial plateau. (Fig. 4.) The remaining condylar surface was displaced slightly downward.

Two days after the accident a reconstruction operation was performed to replace the depressed tibial surface with a graft consisting of the anterior superior spine of the ilium. On exposure of the joint, the lateral meniscus was found to be entirely free from its attachments. The central and anterior portions of the condylar surface were depressed approximately 1 inch. The comminution was so pronounced that any attempt to restore the depressed fragments to normal position would have been futile.

A follow-up examination was made on December 18, 1956, approximately one year and three months after the operation. The knee joint was stable and painless. Complete extension had been regained; flexion was limited a few degrees. The patient had resumed her regular activities, caring for her home and participating in school work.

A roentgenogram taken at the time of the follow-up examination showed the excellent restoration of the tibial plateau and incorporation of the graft. (Fig. 5.)

SUMMARY

The treatment of the severely depressed and comminuted fracture of the tibial condyle presents a difficult problem. Reduction of the finely comminuted and cartilaginous fragments is impossible; elevation of the depressed area is not feasible.

An operative method is described in which the anterior superior iliac spine is utilized to replace the destroyed condylar surface. This process, because of its shape and composition, is singularly adaptable for restoring the tibial plateau.

The new surgical procedure has given satisfactory results in two cases, in one of which a follow-up examination was made more than two years after the operation, and in the other after approximately fifteen months.

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Abscess of the Spleen

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ABSCESS of the spleen, although frequently reported in the earlier literature and frequently seen at postmortem, is not often encountered as an isolated clinical problem. The largest personal clinical series have been gathered from Northern and Southern Rhodesia, Africa, by Wallace [17] and Gelfand [6]. The etiology in these cases has not been entirely clear. Relapsing fever, typhoid and paratyphoid fevers have been suggested as possible etiologic agents. These authors have preferred to consider them as complications of "tropical phlebitis" in which the splenic vessels become thrombosed. Amebic abscess of the spleen has also been described, but this is a rare occurrence.

The mode of development of splenic abscess occurs in one of three ways. In approximately 75 per cent of cases the route is via the blood stream, either via a venous route from intra-abdominal foci or via the arterial route from distant foci. The arterial mode of spread is the more common. All types of bacteria except the gonococcus have gained access to the spleen in this way and have caused splenic abscess. In 15 per cent of cases trauma has been the inciting cause, with occurrence of splenic or perisplenic hematoma and subsequent infection. In 10 per cent of cases spread of infection to the spleen occurs from contiguous organs, namely, stomach, colon or kidney.

The prognosis in splenic abscess, as pointed out by Walker [16], " . . . depends more upon the course of the disease which has produced the splenic infection than any other one factor." In his analysis of a series of thirty postmortem cases and one clinical case he found that there was only a 16.1 per cent chance of having a solitary splenic abscess without abscesses in other organs. Mortality rates have varied widely. Walker estimated a 20 to 25 per cent mortality rate. Inlow [9], in analyzing splenic abscess secondary to trauma, stated that the over-all mortality rate was 58 per cent. It was 100 per cent with medical treatment alone and 38 per cent with surgical treatment. Many cases of splenic abscess, however, are not diagnosed while the patient is alive, splenic symptoms being overshadowed by a violent, septic disease. The diagnosis in these cases is made at autopsy. Inasmuch as mortality rates have been based only on those cases which have been clinically recognized as abscess of the spleen and have been treated, the true mortality rates were probably much higher. On the other hand, the foregoing figures were obtained in a preantibiotic era. Since there has been no large compilation of cases since antibiotics have been available, it is to be surmised that these mortality figures should be reduced. In the four cases that we have found in the literature which were treated after multiple antibiotics became available, plus the case to be presented herein, there have been no deaths.

CASE REPORT

A twenty-two year old white unmarried enlisted man of Italian extraction entered Valley Forge Army Hospital on April 29, 1956, with a diagnosis of ulcerative colitis. He had been

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FIG. 1. Barium enema, revealing moderate shortening of the large bowel with extensive ulceration and pseudopolyp formation. Note the undermining ulcers in the rectum and sigmoid colon.

well until March 3, 1956, when he first began to have bloody diarrhea with eight to ten bowel movements per day. The onset of this disease had followed by one month an emotional upheaval. He was first hospitalized in Germany on March 8th where the diagnosis of ulcerative colitis was made by sigmoidoscopy. He was treated with multiple blood transfusions, and terramycin, but his condition continued to deteriorate. The frequency of stools increased; he vomited occasionally and refused some of his meals. He lost approximately 30 pounds in weight and became rather seriously depressed. His temperature became septic in type, with leukocytosis. Studies for specific etiologic agents were negative. He was therefore transferred to the United States with continuing progression of the disease.

On admission his weight was 120 pounds, temperature 100.4°F., pulse 104 and blood pressure 124/80. The patient was a thin, pale, acutely and chronically ill white man who spent almost all of his time on a bedpan. He was dependent, agitated and easily depressed. He showed evidence of recent weight loss. Positive physical findings were confined to the examination of the oral cavity, abdomen and rectum. Monilial infection of the buccal mucous membranes was present. Abdominal examination showed no distention. The sigmoid colon was palpable and tender, but there was no other tenderness. Peristalsis was hyperactive. There were no palpable organs or masses. Rectal examination was remarkable for multiple broad, deep, longitudinal ulcers with indurated bases, surrounded by overhanging hyperplastic mucosa.

Laboratory work-up revealed normochromic anemia with an elevated sedimentation rate at 33 mm./hour. The white blood cell count was 9,750 per cu. mm., with a normal differential count. Urinalysis was normal. Liver function tests were, for the most part, normal. Serum proteins were low at 5.7 gm. per cent, as was the serum albumin at 2.8 gm. per cent. Stools were positive for gross blood; no enteric pathogens or parasites were found.

On admission roentgenogram of the chest was normal. Barium enema (Fig. 1) revealed the entire large bowel to be involved in an extensive process of ulceration and pseudopolyp formation with moderate shortening of the bowel. Small bowel series suggested a similar involvement in the terminal ileum.

The patient continued to do poorly on the general supportive measures of a low residue diet, vitamin supplements, anticholinergic drugs and multiple blood transfusions. Steroid therapy was withheld. He was transferred to the Surgical Service on May 8th for preoperative preparation. On May 25th, under general anesthesia a total proctocolectomy was performed and an ileostomy fashioned. The terminal ileum was normal on gross examination and on later histologic study. With the aid of 3,000 cc. whole blood, the condition of the patient remained excellent throughout the procedure.

Postoperatively, he received 1,200,000 units of penicillin and 1.0 gm. of streptomycin per day for five days. Intestinal suction was maintained for four days, and he was then given liquids and a soft diet. Semi-solid movements per ileostomy began on the fourth postoperative day. His course was uncomplicated until the seventh postoperative day when he became febrile, and on the eighth postoperative day a developing deltoid abscess at the site of an intramuscular injection was first noted. Incision

FIG. 2. Roentgenogram of the chest (posteroanterior projection) on the day prior to splenectomy reveals an elevated left diaphragm and atelectasis of the left lower lobe of the lung.

and drainage was performed the following day (ninth postoperative day) under local anesthesia. Two ounces of pus were obtained. Culture of this pus revealed hemolytic staphylococcus aureus, coagulase positive, sensitive to chloromycetin® and erythromycin. No antibiotics were given at this time, as it was thought that the abscess was adequately drained; fever subsided to normal on the following day. He then did well, was up and about, ate heartily and began to gain weight. On June 17th, however, fourteen days following the incision and drainage of the abscess and twenty-four days following the colectomy, sudden pain developed in the left upper quadrant of the abdomen, with radiation to the left side of the chest and the left shoulder. The white blood cell count increased to 17,000 per cu. mm. Roentgenograms taken on June 20th (Fig. 2) revealed a high left diaphragm with atelectasis of the left lower lobe. Diagnosis at this time was believed to be subphrenic abscess. Intravenous pyelogram and repeated urinalyses revealed normal findings. It was believed that a short trial of conservative treatment with chloromycetin was in order. This drug was chosen because of its action against a broad spectrum of bacteria and because of the possibility that the chloromycetin-sensitive staphylococcus, cultured from the deltoid abscess, was the etiologic agent in the infection beneath the

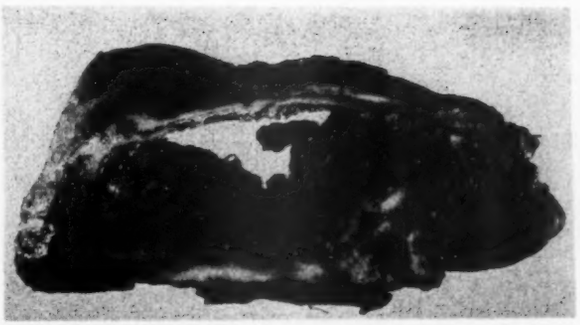

FIG. 3. Transverse section of the upper pole of the gross specimen, showing the greater part of the spleen replaced by a large abscess. Sequestrating splenic tissue can be seen in the interior of the cavity. It was from this tissue that excessive hemorrhage occurred.

left diaphragm. Over a three-day observation period the patient remained acutely ill with septic fever and required narcotics for relief of pain. Abdominal examination revealed tenderness in both upper quadrants, more marked in the left hypochondrium. The spleen and liver were not enlarged on palpation. Because of a lack of response to conservative treatment, the left subphrenic space was explored on June 21st through a left subcostal incision under general anesthesia. At first an extraperitoneal approach was made but no subphrenic abscess was entered. However, a cystic mass could be felt in the region of the spleen. On opening the peritoneum this mass appeared to be located within or closely contiguous to the spleen. It was elected to drain the abscess. After draining the splenic abscess extraperitoneally, however, there was excessive bleeding from the interior of the abscess and from sequestrating splenic tissue. By this time it was certain that the lesion was an intrasplenic abscess. The patient's condition deteriorated rapidly. No blood pressure could be obtained and the pulse was recorded at 180 per minute and was weak. The abscess cavity was packed and the operation was delayed. This delay lasted approximately sixty minutes, during which time the patient received a total of 1,500 cc. of blood. His condition improved. The blood pressure was 90/70 and the pulse 120 per minute. The incision was then enlarged and expeditious splenectomy was performed. It was possible to control the splenic pedicle early. As soon as this was done, the patient's condition, which had again worsened, improved markedly and continued to improve during the remainder of the procedure. The

FIG. 4. Roentgenogram of the chest (posteroanterior projection) on the twelfth day after splenectomy reveals clearing of the lung fields with sharply defined left diaphragm at an almost normal level.

spleen was densely adherent to the underside of the diaphragm; in its posterior and superior aspects a large abscess cavity was situated, replacing 50 per cent of the spleen. (Fig. 3.) The splenic fossa was generously drained through a counterincision. Culture of the splenic abscess again revealed Staph. aureus, sensitive to chloromycetin and erythromycin. Postoperatively 8,000,000 units of penicillin, 2.0 gm. of streptomycin and 2.0 gm. of chloromycetin per day were administered. On June 22, the first day after splenectomy, the patient was afebrile, but on the following day he again began to have fever to 101°F. On this day 2.0 gm. of erythromycin per day (intravenously) was started. The temperature became normal by the sixth postoperative day and remained so. An electrocardiogram taken on the third day after splenectomy revealed an area of focal ischemia in the anterolateral ventricular wall. The ischemia remained and showed progression until July 18th, when stabilization was noted on electrocardiogram. The pathologic condition was presumed to be a septic infarct or myocardial abscess. During this interval 2.0 gm. of erythromycin every day (orally), was continued and the patient was kept on bed rest. Fever did not recur and the pulse remained between 72 and 88 per minute. There was no increase in the cardiac silhouette; cardiac decompensation did not occur, and auscultation of the heart remained normal. On July 3rd, a roentgenogram of the chest (Fig. 4) was nearly normal, with only slight elevation of the left diaphragm and clear lung fields. The original Penrose drains were removed gradually, and on the tenth day after splenectomy a small rubber catheter was placed in the draining sinus for daily neomycin®-bacitracin irrigations. The subcostal wound healed without incident. The sinus healed in eight weeks. The patient was kept at bed rest for six weeks, at which time electrocardiogram had shown complete stability for two weeks. Erythromycin was given for a total of seven weeks. The course remained satisfactory and he gained 20 pounds. Ileostomy continued to function well. The patient was sent to his home on August 22nd, sixty-two days after splenectomy.

COMMENTS

The pathogenesis of the splenic abscess in this case is clearly defined. Metastatic arterial spread of a hemolytic Staph. aureus from a deltoid abscess to the spleen, and probably to the myocardium, occurred. The final good result is believed to be due to a combination of surgery and erythromycin therapy. Although good results prior to antibiotic therapy have been reported, it is thought that this patient had a more widespread dissemination of disease than an isolated splenic lesion and that on the second postoperative day, following initial favorable response to splenectomy, the patient's condition again began to deteriorate. The underlying ulcerative colitis with its hectic course, followed by major surgery of the bowel, had exhausted the patient's reserves. Natural resistance and immunity were not sufficient to heal other metastatic foci without the aid of a specific antibiotic. The initiation of erythromycin therapy at this point brought about slow resolution of fever and an excellent response. Conversely, antibiotic therapy with chloromycetin preoperatively for three days had done nothing to alleviate the situation, and surgery had been necessary. Pollock [*14*] and Reid and Lang [*15*] have pointed out that antibiotics may cause resolution of fever and apparent improvement in the patient's general condi-

tion, thus unduly delaying the necessary surgery.

The diagnosis is made from a history of preceding abdominal trauma, from a primary focus of infection in the abdomen or, more commonly, from a primary focus of infection at a distant site. There is a latent quiescent period, followed in from ten days to several months by sudden or gradual onset of pain in the left upper quadrant of the abdomen and fever. The signs and symptoms produced are localized in the left hypochondrium. Further localization depends on the site of the abscess in the spleen. If the abscess is in the lower pole, the spleen is palpable and tender, and anterior peritoneal signs are present. If the abscess is in the superior and posterior aspects of the spleen, diaphragmatic irritation is present, with an elevated and immobile left diaphragm, radiation of pain to the left costovertebral angle and left shoulder, and splinting of the left hemithorax. This was the picture in the case presented. The differential diagnosis of splenic abscess encompasses two other possibilities, namely, left subphrenic abscess or left perinephric or nephric abscess. Studies suggested to help differentiate the three conditions consist of pyelograms, urinalyses, and gastrointestinal series. Ultimately, surgical exploration is needed for ascertaining the correct diagnosis. For practical purposes, only a possible pathologic condition of the kidney need be ruled on, since the site of the incision will vary. The incision will be more ideally placed in the flank for a kidney or perinephric abscess and in the left upper quadrant of the abdomen for a splenic or subphrenic abscess. In Walker's case [*16*] both incisions were made as a consequence of a negative exploration of the kidney. We favor the subcostal approach, as either a subphrenic or a splenic abscess can be handled through such an incision. It is suggested that a subcostal extraperitoneal approach first be made. If no subphrenic abscess is found high under the diaphragm, the peritoneum should be opened. If the splenic abscess points below the costal margin, splenotomy or marsupialization, in most cases, will be the treatment of choice. It is the abscess at the superior pole and at the posterior surface of the spleen, where adequate drainage is difficult, for which the choice of procedure will vary. In our case splenotomy was attempted but excessive hemorrhage from the splenic pulp necessitated splenectomy. In the literature, results with splenectomy prior to the use of antibiotics varied. Hagen [*8*] reported one death in a series of eight splenectomies in 1900. In 1923 Finkelstein [*5*] reported three deaths in a series of eleven splenectomies. In 1928 Billings [*1*] reported three deaths of four splenectomies. In the recent literature four instances [*2,7,13,15*] of successful splenectomy in treatment of splenic abscess have been reported. Our case report represents a fifth recent successful splenectomy in the treatment of this condition. It seems therefore that when necessary, because of hemorrhage or poor and inadequate drainage, there should be no hesitation in performing splenectomy with the advantage of antibiotic protection. The dissection is, however, commonly difficult due to dense perisplenic adhesions. Because of the sepsis present, early control of the pedicle is recommended. This was made easier in our case because of the absence of the colon. It was the distinct opinion of the anesthesiologist that, simultaneously with clamping of the pedicle, the patient's general condition improved markedly. It was believed that this was not due to control of blood loss alone, for the patient's condition had worsened during the manipulation of the spleen at a time when bleeding was not actively occurring. In view of this experience, early clamping of the pedicle and of the vasa brevia in the gastrosplenic ligament, with as little manipulation of the spleen as possible during these maneuvers, is advised. Since most of these patients are severely and acutely ill, the most expeditiously performed operation which effectively liberates the pus and provides adequate drainage is the operation of choice. Splenotomy with drainage of the abscess will continue to be the most expeditious method for a large, solitary abscess of the lower pole. Splenectomy should be performed when superior and posterior abscesses are found, when multiple splenic abscesses are suspected, when excessive hemorrhage from the spleen occurs at the time of splenotomy, or when rupture of the infected spleen [*15*] occurs. The judicious use of a specific antibiotic in the postoperative period is advised for at least two weeks and, in some cases, even longer because of the possibility of other widespread abscesses.

Since abscess of the spleen follows a distant focus of infection in the majority of cases, mention should be made concerning the role of

antibiotics in the therapy of the distant focus as a prophylactic measure. In patients with chronic debilitating diseases the treatment of a distant focus of infection should consist of a covering broad-spectrum antibiotic in addition to the usual local surgical measures. In our case it was thought that incision and drainage of the deltoid abscess alone was sufficient, and a covering antibiotic was not given. In a healthy young individual this decision would have been valid, but the fact that our patient had had a severe, acute debilitating disease and recent major surgery of the abdomen was not sufficiently taken into account. We believe that we were in error in not doing so. In retrospect, it would seem advisable in a similar situation to administer an antibiotic, probably of a broad-spectrum type, for one day preoperatively and three to four days postoperatively.

SUMMARY

1. A case of splenic abscess due to hematogenous spread of infection from a deltoid abscess in the postoperative period, following total colectomy for idiopathic ulcerative colitis, is presented. Successful result with splenectomy and erythromycin therapy was obtained.

2. The choice of operation, splenotomy vs. splenectomy, and the indications for each procedure are discussed.

3. The role of antibiotic therapy as an adjunct to, but not as a substitute for, surgery in treatment of this condition is emphasized.

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Dysgerminoma of the Ovary

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IN 1931, Robert Meyer [*1*] first described the ovarian tumor known as dysgerminoma. We recently removed a dysgerminoma of the ovary from a three and a half year old white girl. She is the second youngest patient reported with such a tumor. Her case is interesting also because a metastatic lesion was treated for several months before the primary tumor of the ovary was diagnosed.

For years, physicians have recognized that undifferentiated tumors of the ovary occur, but Meyer [*1*] first advanced the concept of the neuter germ cell. He postulated that this tumor is derived from the gonadal cells prior to differentiation into either male or female types and that the cells remain in this neutral state as the tumor develops. Other investigators [*2*] propose that the tumor arises from totipotent gonadal cells that have the ability either to develop along a feminizing pathway to produce a granulosa cell tumor, to develop along the masculine route to form the arrhenoblastoma, or to remain neuter and continue growth as a dysgerminoma. Meyer's concept remains the most popular one to date. Like more recent investigators, Meyer believed that the seminoma of the testis is the male counterpart of this tumor and, as would be expected, the dysgerminoma of the ovary and the seminoma of the testis are similar in their clinical course as well as their response to treatment.

For many years, a dysgerminoma of the ovary was thought to represent a relatively benign lesion. However, most pathologists [*3,4*] now believe that all dysgerminomas are to some degree malignant and that most dysgerminomas are highly so.

PATHOLOGY

Dysgerminomas comprise 3 per cent of all solid ovarian tumors; they occur about a third as frequently as the granulosa cell tumor [*5*]. Although the reported cases have been in persons ranging in age from two to seventy-eight, 72 per cent of these tumors have been found in persons under thirty years of age [*6*].

Meyer [*1*] believed that the tumor is closely related to pseudohermaphrodism, a belief borne out by almost half of his cases. Others also report the dysgerminoma to be the most common malignant tumor of pseudohermaphrodites [*7*]. This lack of gonadal differentiation, however, is not always present. It is now considered that the dysgerminoma of the ovary plays no part in this apparent lack of gonadal differentiation and that pseudohermaphrodism represents only a break in the normal gonadal sexual development.

Dysgerminomas may vary in size from a small, ovid mass to a tumor that fills the entire abdomen. The tumors most often involve the right ovary and about a fourth of them are bilateral. As a rule, the tumor retains the shape of the ovary from which it arises and is covered with a thick capsule in its early development. As growth continues, this capsule becomes thinner. In time, it may perforate and thus permit the contents of the tumor to escape into the peritoneal cavity. Nodules may appear on the surface of the capsule. The tumor is of a solid, rubbery consistency. If cystic areas appear, they represent areas of tumor that have undergone necrosis. On cut surface, the tumor is a grayish yellow. Microscopically, there is a distinctive appearance, for the tumor cells are arranged in alveoli that are separated by a loose connective tissue which is infiltrated with an abundance of lymphocytes. The dysgerminoma cell is large and ovoid and contains a large quantity of clear cytoplasm. The centrally located nucleus is also large and stains heavily with hematoxylin. Mitotic figures may be seen.

Metastasis may take place by way of the lymphatics or the vascular route, and extension directly to neighboring organs is often seen. If

the dysgerminoma perforates, there may be a generalized seeding of the peritoneal cavity.

CLINICAL SYMPTOMS

A pelvic or abdominal mass is invariably the finding that causes physicians to suspect the presence of an ovarian tumor, for a dysgerminoma produces no characteristic clinical symptoms. Abdominal discomfort and an enlarging abdominal mass are the most common presenting complaints. Depending upon the size of the lesion, there may be constipation or urinary frequency. Ascites, if present, usually indicate a poor prognosis. If the patient has signs of hormonal imbalance, such as menstrual abnormalities, authorities feel that the tumor is not a true dysgerminoma. Similarly, if the laboratory reports a positive Friedman or Aschheim-Zondek test, the tumor is probably either a granulosa cell tumor or a teratoma. Unless the tumor involves both ovaries, the patient will have a normal sexual development.

According to Novak, the large majority of these patients are sterile; however, there have been reports of pregnant women with dysgerminoma and also reports of pregnancies following the surgical removal of the tumor.

As the dysgerminoma enlarges, metastatic lesions begin to play a part in the symptom complex; lymph node enlargement, ascites, bone destruction and severe anemia may be found. The following case demonstrates the high degree of malignancy of a dysgerminoma.

CASE REPORT

P. L. F., a three year and five month old white girl, was first admitted to Children's Hospital, Denver, on January 15, 1954, with swelling of the left side of both face and neck. Past history revealed that one and one-half years before admission, a similar swelling of the face and neck had responded to antibiotic therapy. One month before admission, the swelling of the left side of the face recurred, together with an associated swelling of the left side of the soft palate and protrusion of the left eye. In the week before admission, the patient had first complained of a vague abdominal discomfort. There were no other complaints.

Physical examination showed the child to be well developed and well nourished. The left side of the face was moderately swollen anterior to the ear, and the left eye slightly protruded. There was an outward bulging of the left side of the soft palate, and large anterior cervical and left submental lymph nodes were present. In the abdomen, a round, firm mass, which was non-tender and measured approximately 3 cm. in diameter, was easily palpable just above the umbilicus.

The blood count and urinalysis on admission were within normal limits. The serology was negative. Roentgenograms revealed an abnormal rarefaction of the facial and sphenoid bones. Roentgenograms of the chest and abdomen were negative, as was an intravenous pyelogram. The radiologist thought there was a malignant infiltrating process involving the facial bones and the bones of the base of the skull. A biopsy specimen was taken of tissue in the left submental area, and the pathologic diagnosis showed a malignant, undifferentiated neoplasm, probably sarcomatous. (Fig. 1.) Roentgen therapy was advised, and the patient received a total of 4,000 r to the left side of the face and the anterior base of the skull. The swelling of her face subsided, and her palate edema improved. She was discharged February 23, 1954.

She was readmitted on March 23, 1954, with complaints of abdominal fullness, discomfort, and anorexia. The tumor on the left side of the face and the left submental area was not palpable. The aforementioned abdominal mass had enlarged, although it still was situated above the umbilicus and was movable. A provisional diagnosis of ovarian tumor or mesenteric cyst was made. The only unusual laboratory finding was a mild anemia. On March 29, 1954, with the patient under general anesthesia, exploratory laparotomy was carried out, and a large tumor mass involving the right ovary was found. The firm, circumscribed tumor was in the upper abdomen, and it had a long pedicle. In view of the finding of undifferentiated tumor in the neck and face on a prior admission, radical surgical resection was not thought advisable and only the tumor mass was excised. There was no gross evidence of metastatic lesions in the abdomen, and the uterus and left ovary appeared completely normal.

The specimen was a smooth-surfaced cystic mass measuring 10 by 8 by 6 cm., with a solid, 4 cm., yellow-pink nodule at one pole. The cyst contained yellow-tinged, watery fluid and a friable, granular lining. Flattened 3 to 4 cm. daughter cysts were found within the wall of the cyst proper, and cystic areas were noted

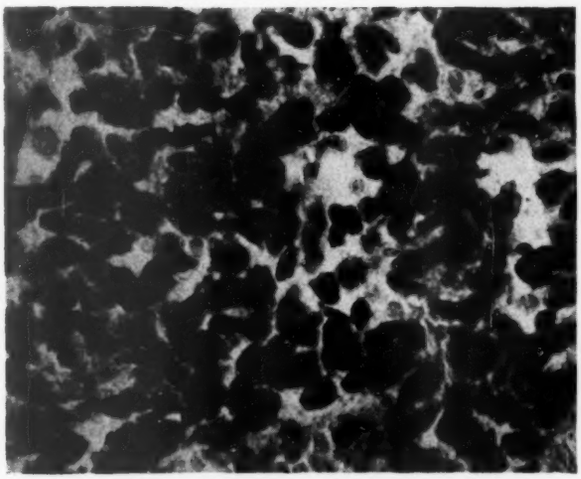

FIG. 1. A microscopic section of the submental tumor, later shown to be a metastatic lesion.

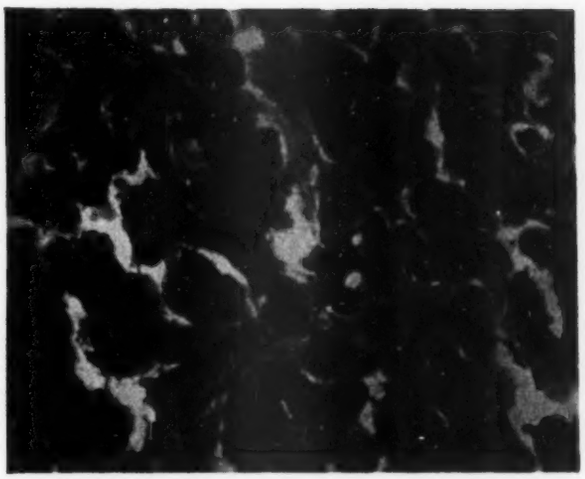

FIG. 2. A higher power microscopic section of the primary dysgerminoma, showing the typical, large nucleated cells.

within the solid nodule and also within the wall of the large cyst. An enlarged, flattened, 7 cm. fallopian tube was stretched over the cyst. Microscopically, the tumor grew in cords and solid masses of hyperchromatic cells with large, round nuclei, prominent nucleoli and moderate basophilic cytoplasm. Thin, fibrous septa separated the neoplastic cells. Mitotic figures and bizarre, multinucleated cells and symplasmic cell masses were common. (Fig. 2.) There were many alveolar structures lined with well preserved tumor cells. In some instances, the cells formed tubules and papillary processes. The tumor was encapsulated and did not appear upon the serosal surface of the capsule or involve the normal fallopian tube. The tumor lined vascular spaces in some places, and similar tumor was seen within the capsule. The diagnosis was dysgerminoma of the ovary. No pathologic change was noted in the fallopian tube.

A review of sections of the submental biopsy specimen made it evident that this lesion was a metastasis from the primary dysgerminoma of the ovary.

The patient recovered uneventfully from the abdominal operation, but films of the skull showed a progression of the tumor process. Additional roentgen therapy to the skull was given before her discharge.

She was readmitted on June 8, 1954, with complaints of loss of appetite, loss of weight and pain in her legs. Red blood count was 3.67 million per cu. mm. with a hemoglobin of 11 gm. per cent. Sedimentation rate was 65. Roentgenograms again revealed increasing bony involvement of the skull by a malignant process. During this hospitalization, additional roentgen therapy to the skull and transfusion therapy were carried out. The patient's course was steadily downhill. When she was finally admitted on October 8, 1954, she was again anemic. She continued to complain of increasing pain in her arms and legs and she ran a daily fever. Her abdomen was distended, the red blood count was 1.84 million per cu. mm. with a hemoglobin of 4.75 gm. per cent. Her condition rapidly deteriorated, and she died on October 26, 1954.

At autopsy, multiple metastatic lesions from the dysgerminoma were found involving the cervical nodes, mediastinal nodes and bones of the skull. Nodules in the brain also showed typical dysgerminoma cells. Examination of the bone marrow revealed a severe thrombocytopenia secondary to extensive bone marrow metastases. The final pathologic diagnosis was that of a highly malignant dysgerminoma of the ovary with metastatic lesions to the aforementioned organs.

TREATMENT

For many years after Meyer first described the dysgerminoma, most pathologists and clinicians believed that it was a relatively benign tumor as compared with the granulosa cell tumor and the adenocarcinoma of the ovary. Removal of only the involved ovary was the accepted method of treatment. As most of the patients were in the second and third decade of life, the child bearing potentiality of the patient was thought to be more

important than the malignant potentiality of the tumor.

It has become increasingly apparent, however, that the five year survival rate is low. Some authors report a five-year survival of only 12½ per cent [7], others from 25 to 40 per cent [4,5]. In an effort to improve these figures, some investigators recommended routine roentgen therapy to these tumors, for like their counterpart, the seminoma of the testis, dysgerminomas are very radiosensitive. During the past six years, there has been a growing trend toward more radical surgical operations in addition to roentgen therapy. Pedowitz [7], Mazel [8], Mandeville [9] and others [10] now advocate extensive surgical procedures and believe that a radical panhysterectomy, in addition to removing the tumor, is indicated. Novak, likewise, says that as most of these young women are sterile, radical surgical procedures are indicated in view of the malignant potential of this tumor. The operation should then be followed by deep radiation therapy.

COMMENT

Many dysgerminomas have been reported in young women. In 1928, Hunt and Simon reported a tumor of the ovary in a seventeen-month old infant, but the article does not necessarily imply that the tumor was a dysgerminoma. The tumor reported by Fein [11] in 1934 in a two year old is of the typical dysgerminoma microscopic picture. The case presented here would be the next in chronologic order, as the first positive biopsy was made of a metastatic dysgerminoma lesion when the patient was three years and five months of age. Swelling of the neck first developed in this patient when she was eighteen months old but, since no biopsy specimen was taken at that time, it is not possible to state that this was due to metastatic disease. Her clinical course which followed this swelling was that of generalized metastases.

As this case illustrates, dysgerminoma of the ovary is a malignancy of the young woman with approximately 75 per cent of these tumors occurring in patients under thirty years of age. Although once considered to be of low grade malignancy, it has now been shown to be highly malignant; in most cases, the five-year survival is only 25 per cent. The usual presenting symptoms are lower abdominal pain and a palpable mass. Surgical removal of this tumor and a radical panhysterectomy should be performed, followed by deep roentgen therapy.

SUMMARY

A case of dysgerminoma of the ovary in a three and one-half year old child is reported. A metastatic lesion in the neck was the presenting symptom. The primary tumor was diagnosed several months later. If this tumor is diagnosed before metastasis occurs, a radical panhysterectomy followed by roentgen therapy is the treatment of choice.

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Pheochromocytoma

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THIS article is presented as an unusual and interesting example of a large pheochromocytoma which was functionally active for at least three years prior to its removal. The tumor weighed 1,620 gm. and measured 17 by 16 by 10 cm. In reviewing the English literature we have been unable to find a report of a pheochromocytoma of this size. The largest previous one reported weighed between 1,000 and 1,100 gm. There is a report of one case in the Swedish literature in which the tumor was described as weighing about 2,000 gm.

CASE REPORT

H. S., a sixty-five year old widow, was admitted to the Bryn Mawr Hospital, Bryn Mawr, Pennsylvania, on December 2, 1954. She gave a history of having had paroxysmal attacks of palpitation, sweating, pounding of the heart and headaches for the past three years. These attacks occurred characteristically at night, would awaken her and would last only a few minutes. They had increased in frequency during the past year and a half, and at the time of admission also occurred occasionally during the daytime. Prior to this admission to the hospital she had never been examined by a physician during one of these attacks.

In 1951 she had been studied for suspected diabetes and hyperthyroidism. At that time she had had generalized arteriosclerosis, a blood pressure of 180/110, a diffusely enlarged thyroid gland, 4 plus acetonuria, a blood sugar of 196 mg. per cent and a basal metabolic rate of plus 20. In January, 1952, a tracer dose of 200 microcuries of I-131 was given to her, and the uptake in twenty-four hours was 38 per cent and in forty-eight hours it was 36 per cent. She was considered to have mild hyperthyroidism and was treated with 8 millicuries of radioactive iodine. It was soon after this (February, 1952) that she first noted the attacks of palpitation and pounding of the heart. The patient's husband was seriously ill during 1952 and early 1953, and many of her symptoms were attributed to nervous strain brought on by the care of an invalid husband.

Her diabetes was well controlled with NPH insulin and a diabetic diet. She was carefully followed up at monthly intervals both for the diabetes and the mild hypertension, which ranged from 140/80 to 180/100. (Fig. 1.)

Her past medical history revealed no serious illnesses, accidents or operations. Her mother had diabetes but the family history was otherwise negative.

Physical examination on this hospital admission revealed several interesting findings. The thyroid gland was firm and contained several small, discrete, hard nodules. The blood pressure was 170/106, pulse rate 100 and respirations 20. There was slight enlargement of the heart to the left and a soft systolic murmur was heard at the apex. The liver was felt 2 to 3 cm. below the right costal margin. There was a large, non-tender, hard, slightly irregular, movable mass filling the left upper quadrant of the abdomen. The mass extended across the midline and down to the level of the umbilicus. The left costal arch was pushed by the mass and was more prominent than the right. The tumor moved slightly with respiration.

On the night of admission she had one of her typical attacks with palpitation, pounding of the heart and headache. She was seen by an intern and her blood pressure was 280/120. In twenty minutes the blood pressure was down to 194/92 without any treatment. The intern suggested that this blood pressure response might be due to a pheochromocytoma.

The patient's fasting blood sugar was 284 mg. per cent on December 3rd. Her basal metabolic rate was plus 35 on December 4th. A regitine® test on December 6th produced a drop in blood pressure from a basal of 160/90 to 128/60 at the end of sixty seconds. These findings were

suggestive of a pheochromocytoma but were not conclusive.

An intravenous urogram taken on December 6th revealed a soft tissue mass displacing the left kidney downward, but it was not possible to tell whether this was an intrinsic or an

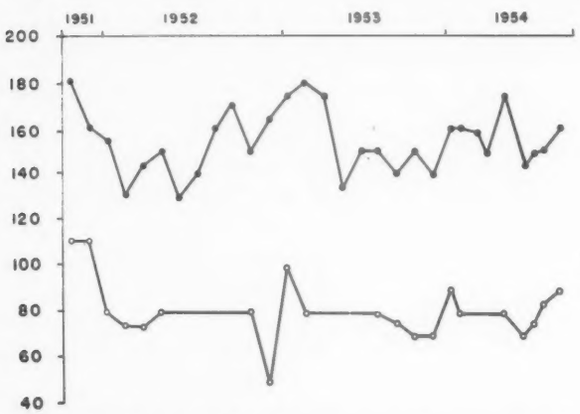

FIG. 1. Graft showing blood pressures taken at intervals from 1951 to 1954.

extrinsic mass. A left retrograde pyelogram taken on December 9th showed the same mass in the left upper quadrant of the abdomen which was suggestive of a suprarenal lesion.

On the night of December 12th she was seen by the author during one of her attacks and her blood pressure was 250/120. She was given benzodioxane intravenously, and after receiving 8 mg. the blood pressure dropped to 190/100 within two minutes, then rose again to 220/80, and an additional 32 mg. of benzodioxane failed to reduce the pressure further in the succeeding thirty minutes. Sodium amytal® (gr. vii ss) was then given intravenously and the blood pressure dropped immediately to 160/70. This test was also not conclusive evidence of the presence of a pheochromocytoma, but was suggestive. However, a clinical diagnosis of pheochromocytoma of the left adrenal was made and the patient was prepared for an exploratory operation. She was given 5 mg. of DOCA® and 50 mg. of cortisone the night before and the morning of operation.

On December 14th we operated upon the patient under pentothal,® nitrous oxide, ether and oxygen endotracheal anesthesia. A transverse upper abdominal incision was made about 2 inches above the umbilicus and extended into the left ninth intercostal space after dividing the costal arch. The diaphragm was split, the ribs retracted and a large retroperitoneal tumor filling the entire left upper quadrant of the abdomen was exposed.

The distal half of the pancreas was stretched out over the tumor, the splenic vessels were greatly enlarged and the spleen was perched

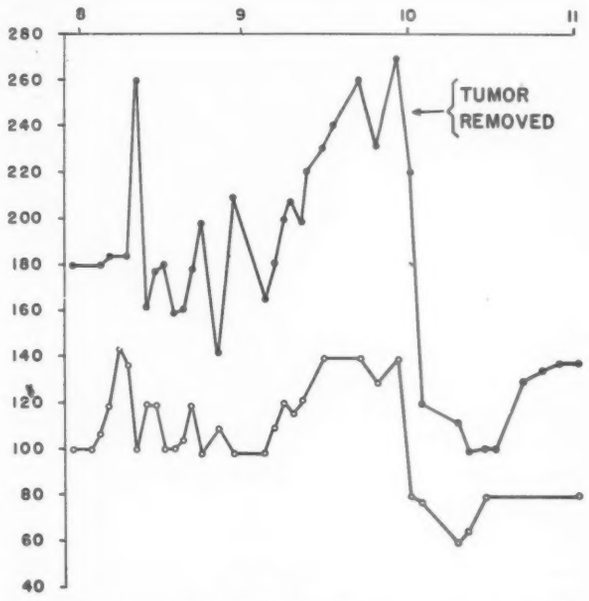

FIG. 2. Graft showing blood pressure response during operation and after removal of the tumor.

on the most superior part of the tumor like a cap. The splenic vessels were ligated and divided along the superior border of the distal third of the pancreas, and the tumor was dissected free from the diaphragm, retroperitoneal attachments and the kidney, and rolled medially. A large adrenal vein and artery were identified, ligated and divided; several smaller ones were also ligated. We were then able to remove the tumor completely.

During the manipulation of the tumor the blood pressure rose to 270/140 on one occasion and the patient was given 3 mg. of regitine intravenously. We were able to reduce the blood pressure on several occasions by discontinuing manipulation of the tumor for five minutes. (Fig. 2.)

Immediately after removal of the tumor, the blood pressure dropped to 100/70. The blood pressure was maintained at about this level with an intravenous drip of neo-synephrine® (20 mg. in 500 cc.) during the next three hours.

The tumor was roughly rounded, reddish purple in color, somewhat nodular and partly

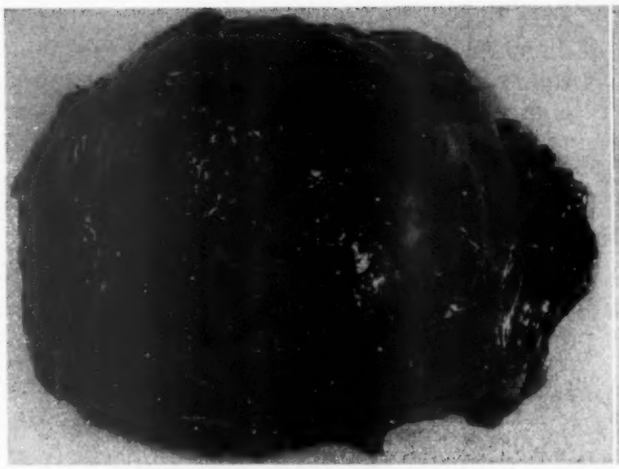

FIG. 3. Photograph of tumor after removal.

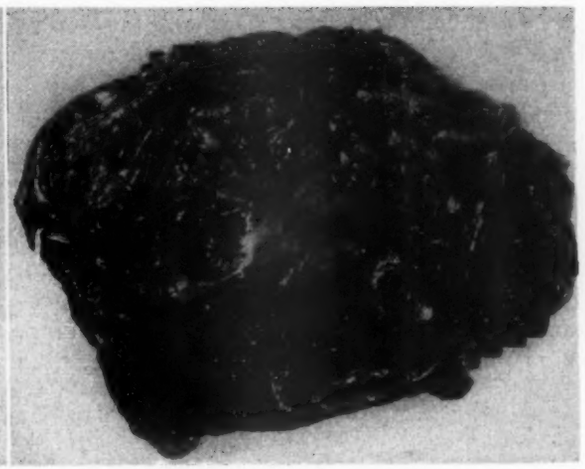

FIG. 4. Photograph of cut section of tumor.

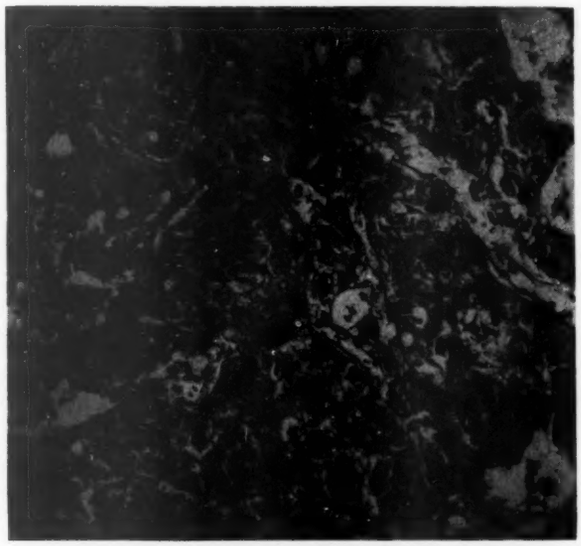

FIG. 5. Photomicrograph of tumor.

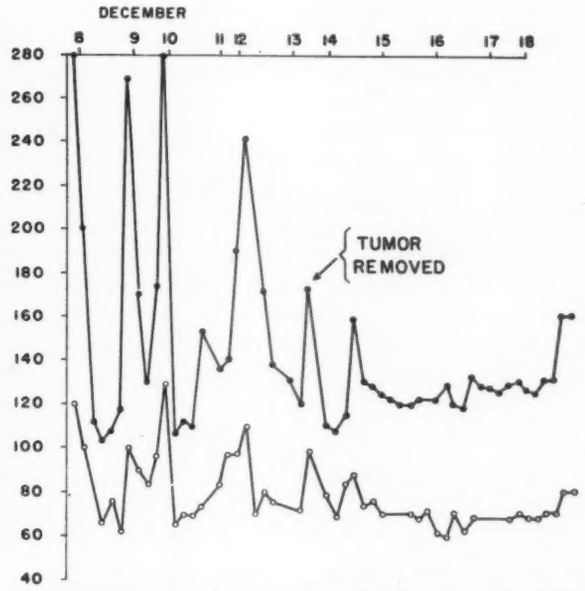

FIG. 6. Graft showing recorded blood pressures while patient was in the hospital before and after operation for removal of tumor.

cystic. It was covered by a smooth capsule and measured approximately 17 by 11 by 10 cm. It weighed 1,620 gm. Cut section revealed several cystic spaces filled with thin bloody fluid. The solid areas were composed of pale brown friable tissue. (Figs. 3 and 4.)

Microscopic section of the tumor showed it to be composed of masses of cells with generally small- or moderate-sized nuclei and a rather abundant amount of pink, finely granular cytoplasm. Some of the cells were vacuolated. The tumor was extremely vascular with many capillaries running between nests and cords of cells. In general, the cellular outlines were poorly defined; the cells were fairly uniform but there were numerous cells with extremely large hyperchromatic nuclei scattered throughout the lesion. Mitotic figures were very rare. The tumor was well encapsulated with foci of calcification in the capsule. (Fig. 5.)

The patient had a smooth postoperative course. The blood pressure stabilized at around 140/70 after the first twenty-four hours and she had no attacks of palpitation during her convalescence in the hospital. (Fig. 6.)

She was discharged on December 31, 1954, and has been followed up at monthly intervals since that time. Her blood pressure now ranges from 130/80 to 150/80 and she has had no attacks of palpitation and pounding of the heart since the day of her operation. She was

last examined on October 6, 1956, and at that time she weighed 117 pounds, the blood pressure was 130/80 and the pulse 76. She had a blood sugar of 110 mg. per cent one and a half hours postprandial and no longer required insulin for control of the diabetes.

Graham [1] reviewed 207 cases of pheochromocytoma associated with hypertension and reported in the world literature up to 1949. The incidence according to sex, age and location on the right or left side was not striking. In 11 per cent of the patients bilateral tumors were found. Ten per cent of the patients had diabetes. Only 14 per cent had a palpable tumor. Eleven per cent of the tumors were malignant. The operative mortality rate in 125 cases was 26 per cent. It was estimated that more than 800 patients die annually in the United States of America of this disease.

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The Nurse and the Outpatient Department. By Audrey Windemuth, R.N., B.S. 580 pages, with references at chapter endings and an index. New York, 1957. Macmillan Co. *Price* $6.50. (A must for anyone interested in or connected with a hospital outpatient department.)

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Retention of a Pulmonary Segment Following Interruption of the Bronchus, Artery and Vein

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THE survival of a pulmonary segment, after its bronchus and blood supply have been surgically divided, is most uncommon. Although the actual survival of parenchymal tissue which was defunctionalized but perhaps not completely devitalized is unusual in itself, the circumstances which prompted this decision were such that a case report would seem of interest.

CASE REPORT

A. B., a twenty-eight year old white man, was first hospitalized in August, 1953, with a six months' history of pulmonary symptoms. Tuberculosis was diagnosed by positive sputum culture. Multiple chemotherapy was begun with streptomycin, PAS and INH.® On January 14, 1954, the patient was transferred to the Sunmount Veterans Hospital. Admission x-ray revealed irregular densities involving the apices and infraclavicular areas bilaterally. A small cavity in the left upper lobe was suspected by planigrams. The original drugs were continued. Admission sputum was negative. Planigram five months following admission was unchanged and suggested a slit-like radiolucency (Fig. 1) in the left upper field posteriorly. A residual cavity could not be ruled out in the posterior segment of the upper lobe or superior segment of the lower lobe. A left thoracotomy was recommended for removal of this residual disease.

After mobilization of the left lung, the lesion was found to be a thickened, fibrotic, indurated area at the junction of the superior segment of the lower lobe and posterior segment of the upper lobe. This was, presumably, the cavity bearing area, since the findings in the remainder of the lung were not significant. It was decided that the lesion could be adequately removed by superior segmentectomy with an attached wedge from the adjacent posterior segment, since the fissure was fused. Dissection of the pulmonary artery proceeded in the usual manner. After the posterior segment artery had been identified and dissection was exposing the superior segment branch, sudden hemorrhage was noted from the main pulmonary artery. Digital pressure and inspection revealed a small tear near the origin of the posterior segment artery. This was controlled with two interrupted sutures of arterial silk after five minutes of digital pressure failed to halt the bleeding. Since this accident had occurred at a moment when no instruments were near the vessel and was 1 to 1.5 cm. above the superior segment branch, it was decided that it probably resulted from undue traction on the lung. Accordingly, the lung was retracted with the utmost gentleness and the superior segment artery and vein were interrupted without further incident. Because the superior segment bronchus was adherent to the main pulmonary artery, for safety's sake the bronchus was divided near its trifurcation into subsegmental branches rather than at its origin from the main stem bronchus. As blunt dissection of the hilum was begun to remove the segment in routine fashion, a small fountain of blood erupted from the ventral surface of the main artery, entirely away from any branches. This was easily stopped with finger pressure for three to five minutes. The artery did not appear unduly friable or atherosclerotic.

The site of dissection was changed so that rather than place any traction on the divided

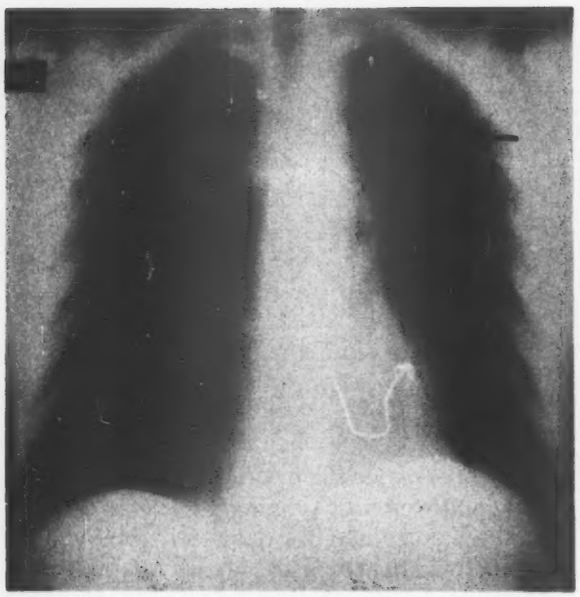

FIG. 1. Planigram five months after admission showing slit-like radiolucency in left upper lung field.

FIG. 2. Twelve days postoperatively; note absence of segmental atelectasis.

hilum of the superior segment, and indirectly on the artery, an attempt was made to wedge part of the posterior segment in a retrograde manner beginning at the lung periphery. By this time the lung was barely suspended by the assistant to minimize traction. However, a third spontaneous rupture occurred in the surface of the main artery similar to the second, but about 1 cm. distant. This, again, was arrested with prolonged digital pressure.

At this point further attempts at any type of resection were deemed unwise. Both proximal and distal stumps of the divided superior segment bronchus were closed with three or four interrupted silk sutures. The lung was carefully inflated so that it rose over and sealed the underlying pulmonary artery. The superior segment of the lower lobe was now almost fully inflated apparently from collateral air drift. The lung was maintained on positive pressure during chest wall closure. Under water suction was then instituted to insure expansion in the hope that the lung would overlay and adhere to the pulmonary artery.

Realizing that there was probably no precedent for this procedure, as the operation progressed, it became a matter of necessity. In the face of three spontaneous "traction ruptures" in the main artery, it was believed that further attempts at resection would jeopardize the patient's life or result in a probable pneumonectomy. No unusual bleeding was noted in the first twenty-four hours after operation. Convalescence was uneventful. We were both surprised and pleased to note in postoperative x-rays the absence of any discrete segmental or subsegmental atelectasis in the area of the superior segment left lower lobe. (Fig. 2.)

Follow-up evaluation at intervals of six months and one year after thoracotomy has indicated the patient is in good general health with a normal work capacity. There is no evidence of tuberculous activity by gastric or x-ray examinations. Bronchograms one year postoperatively revealed filling of the superior segment bronchus to the point of transection at the origin of the three subsegmental branches. (Fig. 3A and B.)

COMMENTS

It might have been anticipated that interruption of a segmental bronchus would not necessarily result in a resorption type of atelectasis.

In 1929, Van Allen, Lindskog and Richter [1] carried out both *in vitro* and *in vivo*, experiments on the dog which demonstrated the existence of alternate peripheral or indirect pathways for air drift between segments when the direct bronchial route had been occluded. By collecting the collaterally ventilated gas they found a close correlation with expected alveolar gas tensions. These collateral pathways were estimated to be at least 10 per cent efficient and later workers revised this upward to 40 per

FIG. 3A. Bronchogram one year after operation.

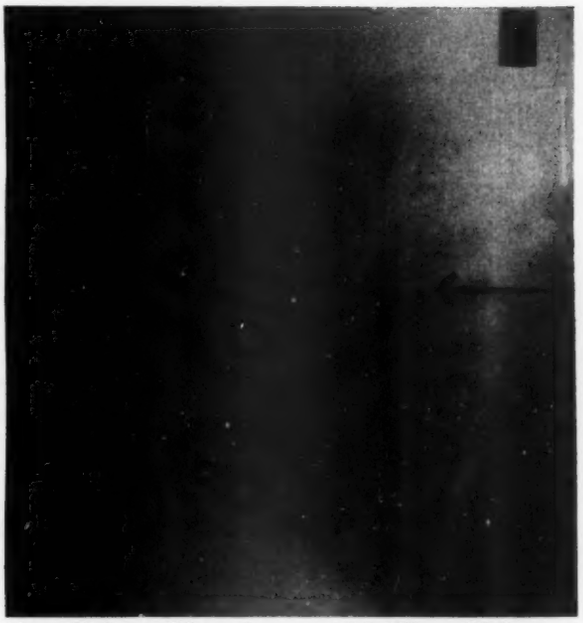

FIG. 3B. Lateral bronchogram with filling of left superior segment bronchus to point of interruption at trifurcation of subsegmental bronchi.

cent when comparing collateral air with that respired by direct channels.

Both the existence and efficiency of collateral ventilation were further substantiated by Baarsma and his associates [2] as a result of clinical and experimental observations in man, using endobronchial inflatable catheters. However, these investigators emphasized the importance of anatomic variations in the phenomenon of collateral respiration.

In those instances in which a nearly complete anatomic fissure might exist between segments, the movement of collateral air could well be decreased to absent.

Similar to the compensation available in ventilation, following division of a segmental bronchus, is the collateral circulation which develops after interruption of the bronchial arteries.

Ellis and co-workers [3] state that there should be no concern regarding the blood supply to the distal end of a divided bronchus when the bronchial arteries are severed by injury; or possibly, as in the case herein reported, by deliberate surgical division. This is apparently due to the numerous collateral vessels that exist, since experimentally it is extremely difficult to deprive the bronchi of their systemic arterial supply. Studies in the authors' laboratory indicated that the collateral blood supply, via the pulmonary arteries, can adequately supply the nutritional needs of the bronchi distal to the hilar region, even if the bronchial arteries and the systemic collaterals are thoroughly occluded.

However, since the potential or actual bronchopulmonary precapillary anastomosis implies the existence of a patent pulmonary system, it follows that interference with both bronchial and pulmonary arteries to a segment might prevent this collateral circulation.

Dargent and Berard [4] ligated the pulmonary artery to the left apical segment in a dog, following which the lobe underwent autolysis in four to eight days. Roentgenograms of the lung following injection of radiopaque material into the aorta revealed absence of the bronchial arterial circulation to the involved lobe. Although it has been known for some time that ligation of a pulmonary artery in a normal dog is usually not followed by infarction, interference with both bronchial and pulmonary arteries at a lobe level could well be followed by an appreciable incidence of gangrene. Whether or not one could anticipate survival of a lobe in man following surgical division of both arterial systems is unknown. Presumably in a segmental area, there is greater opportunity for pulmonary arterial collateral to contribute from adjacent segments, whereas the presence of anatomic fissures and the fact that pulmonary arteries are end arteries, may preclude this possibility in a lobe.

SUMMARY

1. The survival of a pulmonary segment (superior segment, left lower lobe) following complete surgical interruption of its bronchus, pulmonary artery and vein is reported.

2. Retention of this segment was forced when three spontaneous traction perforations occurred in the left main pulmonary artery, following attempted resection.

3. Clinical and radiologic evidence for survival of this segment is presented.

4. Experimental evidence is available to describe the role which collateral ventilation and circulation play in the survival of a bronchopulmonary segment.

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Omphalocele

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ALTHOUGH an umbilical hernia is a common occurrence, an omphalocele is a surgical rarity. Omphalocele differs from umbilical hernia in that it is an umbilical herniation of viscera covered over by a moist pellucid membrane lined internally by peritoneum and externally by amniotic membrane.

Historically, this condition has been described as far back as 1640 by Ambrose Pare. Since dessication of the covering membrane and peritonitis rapidly supervened, death was inevitable. Up to 1949 only about 400 cases have been reported in the literature with a mortality rate varying up to 50 per cent. Several interesting series have been reported by Gross [1], Jaucho [2], Maguire [3], Ferguson [4], Kern [5] and Malloy [6]. The incidence of this anomaly in birth statistics varies with reports. Statistics from Sweden and other continental countries indicate an incidence of 1 to 7,500 births. Kahle [7] found approximately the same incident rate in this country. The embryologic development has been ably described by Ferguson [4], Gross [1] and others.

The treatment of this condition has been accepted as surgical. The technic must be varied according to the size of the omphalocele; in the largest area a simple closure of skin only, as recommended by Gross [1], is imperative if the baby is to survive. In the smaller type, a complete ventral herniorrhaphy is the procedure of choice.

In our opinion, there are several pitfalls to avoid if possible. Immediately at birth the intestinal tract is empty of air and bacteria; the intestines are collapsed and occupy a minimum of space in the abdominal cavity. Since these babies have not had the full component of viscera in the abdominal cavity, they have lost their habitat and returning them will cause excessive pressure on the diaphragm. A similar circumstance occurs with the reduction of a diaphragmatic hernia in the newborn. Therefore, surgery within a very few hours is of vital importance. This fact is born out by O'Leary and Clymer [8] and Kern [5] who showed that the mortality rate went from 20 per cent in the first twelve hours to 40 per cent in twenty-four hours and 60 per cent after twenty-four hours. Secondly, if a scrotal hernia is present, it will allow more intraperitoneal space. Sterile wet gauze over the sac helps prevent early dessication of the omphalic sac. Postoperatively a small Levin tube in the stomach should be used if respiratory embarrassment develops.

Although we have had seven cases of omphalocele, we wish to report only one case. There were two deaths; both patients had extensive congenital anomalies inconsistent with life. One infant had extrophy of the bladder with abnormal sexual development to such an extent that sexual differentiation could not be made, even at autopsy.

CASE REPORT

Baby J. F., born July 17, 1947, at Grant Hospital, was seen by us within two hours of his birth. The father was forty-three and the mother thirty-seven. They had been married fifteen years without a pregnancy so they were particularly anxious to have a child. It was essentially a normal low forceps delivery with median episiotomy and otherwise not remarkable. The child was apparently well developed and nourished, with normal respiration and heart action. However, a large omphalocele was present as noted in Figure 1. Bilateral large scrotal hernias were also present. The omphalocele was covered with moist sterile saline dressings and towel and the infant placed in the nursery. He was taken to surgery approximately four hours after birth and under drop ether anesthesia, the omphalic sac was excised at the skin borders and removed. There was a

FIG. 1. Large omphalocele showing intestines and liver in sac.

FIG. 2. Note scaphoid abdomen and distended scrotum.

FIG. 3. Same patient at seven years of age, one year after ventral herniorrhaphy.

round liver present and all the small intestine. The liver had a lobulation that was not normal but was entirely round from the position it had assumed in the omphalic sac. Since there was no air in the intestines, they were small and deflated. The fascial edges of the rectus muscle were freed and the skin subcutaneously freed for a wide area from the abdominal wall. The viscera were returned to the abdominal cavity under considerable tension, part of which was relieved by the presence of the scrotal hernias. The fascia could not be brought together in the midline and therefore no effort was made to close it. The skin, which was undercut, was brought over the peritoneal defect and closed with 000 silk. The infant was returned to the nursery, with oxygen, and a small catheter inserted in the stomach for constant suction. His course was very satisfactory after this, and he was maintained on intravenous fluids for three days. Meconium stools were passed and there was a normal urinary output. He was started on small feedings and made an uneventful recovery except for the scrotal hernias which became considerably larger as the intestines assumed their normal function. A large ventral hernia was also present. (Fig. 2.)

Six months after birth, the right inguinal hernia was so large and bluish in color in comparison to the thin scrotal skin that it alarmed the parents. It was decided that a right inguinal herniorrhaphy should be performed. This was undertaken in a routine manner with a good result. No effort was made to repair the left hernia because we felt that it was a necessary vent for intra-abdominal pressure which was still present.

The child had normal growth and activity. He was seen at regular intervals until the age of seven when it was decided to repair the ventral hernia. Up to this time, he had worn an elastic bandage to control the size of the ventral hernia. A smaller but recurrent right indirect inguinal hernia developed.

On June 14, 1953, he was taken to Children's Hospital and a ventral herniorrhaphy was performed. The fascia of the mid-abdomen was dissected laterally for about four inches on either side. The rectus muscles could not be approximated but the fascia was split in the middle and the left leaf brought under the right side of the fascia with 4-0 silk. The right side of the fascia was imbricated over the left side with 4-0 silk which reduced the defect and brought the rectus muscles much closer together. This was followed by a left inguinal herniorrhaphy.

The child had a normal recovery from this surgery, with a good result. On August 18, 1953, he was returned to the hospital and the recurrent right inguinal hernia repaired without complications.

This child is now a normal growing boy with a mild weakness in the upper abdominal wall which is symptomless and with an adequate repair, in our opinion. (Fig. 3.)

SUMMARY

Large omphaloceles can be successfully repaired if the physiological problems are kept in mind. Since the normal habitat of the viscera in the abdominal cavity has not taken place at the time of repair, this must be taken into consideration. The frequent association of scrotal hernia is a safety factor in recovery. It would probably be a good idea to make a scrotal hernia at the time of surgery if the intra-abdominal pressure seems too great. Skin coverage is the important thing and repair of the fascial defect can be made at an appropriate elective time at any later date. Early repair before bacterial contamination of the abdominal cavity is vital. Early repair before the intestines fill with air, food and bacteria is also essential. The heredity role is mentioned in this case because we have repaired a bilateral hernia in the father and a right inguinal hernia in the grandmother. It will be interesting to know what the male sons of this boy will show from the standpoint of omphalocele and hernia in the future.

CONCLUSION

Immediate surgery without undue intra-abdominal pressure has, and should continue, to lower the mortality rate in this rather rare condition. Postoperative decompression for a few days is necessary to allow intra-abdominal adjustment of the liver and intestines. Skin coverage is the vital factor because fascial defects can be repaired at any later date in the child's development.

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Hypernephroma in a Child

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THE following case report is prompted by the rarity with which this lesion is encountered in pediatric urologic practice.

CASE REPORT

The patient was an eleven year old boy, who was in excellent health until ten days before his first visit. At that time it was noted that his urine was dark. Urinalysis showed microscopic evidence of blood, whereupon he was referred for urological consultation. The history with reference to his present complaint was completely lacking in important or contributory details. Physical examination likewise revealed no abnormalities. The voided urine contained albumin and many red cells, and casts were not present. He was admitted to the hospital several days later for a complete urological survey. In the meantime the hematuria had abated. Cystoscopic study failed to reveal any lesion in the bladder or urethra. Both kidneys functioned normally. Catheters were passed easily to each renal pelvis. Pyelography indicated a normal left urinary tract. On the right the renal outline was normal in size and contour. The middle calyx of the right kidney was widened and filled irregularly, but the changes were not considered to be conclusive enough to warrant a definite diagnosis. Cultures of the urine were negative for bacterial growth. A full restudy was advised after a lapse of several weeks. Hence, three weeks later an excretion urogram was taken. Meanwhile hematuria recurred and persisted. The urogram showed good excretion from the right kidney. (Fig. 1.) The upper and lower calyces were normal in configuration. On none of the films was a middle calyx outlined. The left side was normal. Because of the fact that on the previously executed retrograde pyelogram a middle calyx had been observed, it was believed that a pathologic disease was present in this portion of the kidney. The child was accordingly readmitted to the hospital for confirmatory retrograde studies. At the time of the second admission active hematuria was present, which, on cystoscopy was seen to originate on the right side. The pyelogram (Fig. 2) again showed a dilated middle calyx irregularly filled with dye. Our belief now was that sufficient evidence was at hand to warrant surgical exploration. The diagnosis provisionally was a neoplasm (possibly primary in the renal pelvis), which invaded the adjacent parenchyma and thus accounted for the findings on the excretion urogram.

At operation the kidney was exposed and delivered easily. Its size and outline were normal but a distinct area of circumscribed induration could be detected in its middle segment. The kidney was removed and immediately submitted for examination by the pathologist so that ureterectomy could be performed in the event that a papillary lesion was present. However, such was not the case as subsequent description will demonstrate. The patient's postoperative course was completely uneventful. He was discharged from the hospital on the tenth day after operation.

The pathologist's report indicated that the specimen weighed 146 gm. The capsule stripped easily. On section, in the cortex of the kidney, there was an ovoid mass, well encapsulated, measuring 2.2 cm. in diameter, filled with yellowish gray, friable tissue. Small areas of hemorrhage were seen in the tumor tissue and also around the mass. The rest of the cortex showed no features of note. The pelvis and calyces likewise showed no features of note.

Microscopically, the tubules and glomeruli were for the most part normal. In certain areas dense hyalinzing connective tissue was present wherein were noted tubular structures lined by cuboidal or flattened epithelium. There were groups of clear, tall cuboidal and columnar cells, with basally located round, vesicular nuclei. In

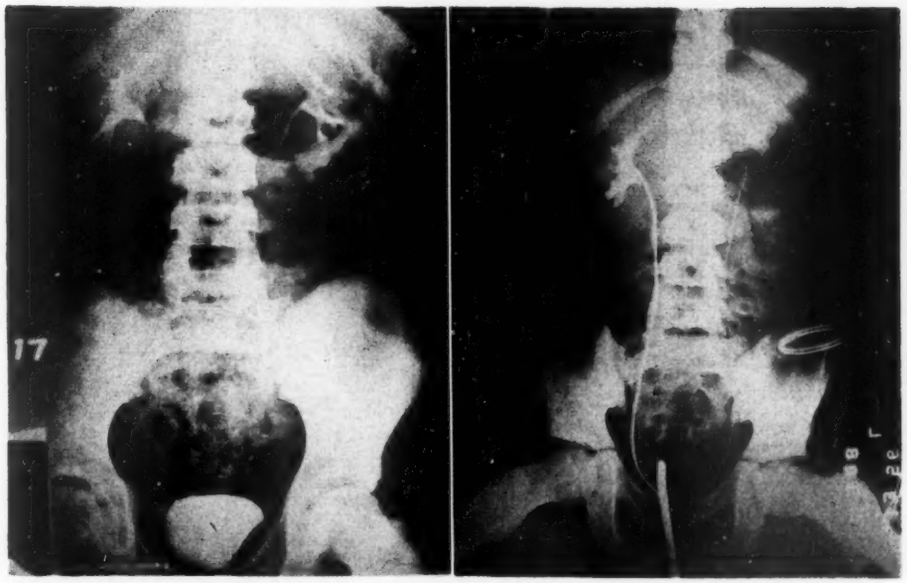

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FIG. 1. Intravenous pyelogram showing the absence of the middle group of calyces on the right.

FIG. 2. Right retrograde pyelogram showing the faintly filled, irregular bulbous appearance of the middle group of calyces on the right.

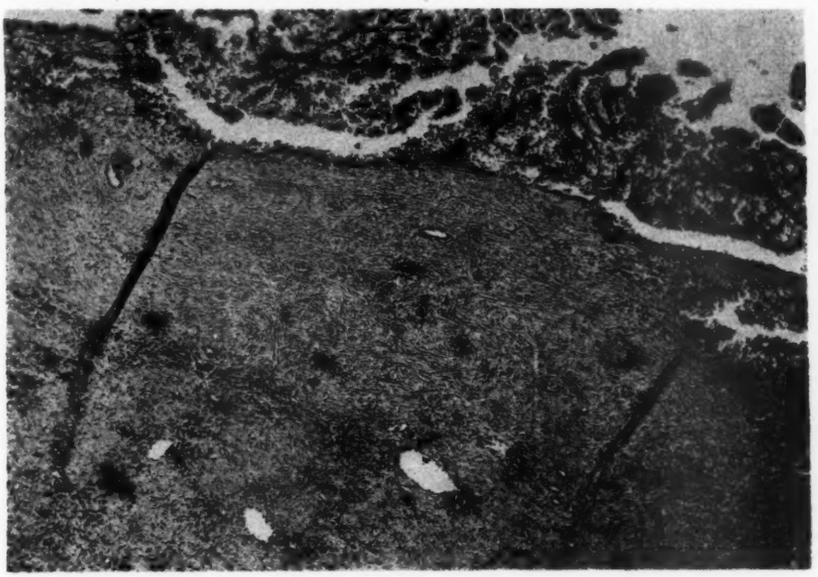

FIG. 3. The tumor appears circumscribed and is walled off by a layer of dense, fibrous tissue. Part of the tumor is seen and is composed of clear cells, mounted on thin fibrous tissue stalks, presenting a papillary pattern. There is minimal necrosis and hemorrhage, not noted in this field. Original magnification, × 125.

some areas a papillary character was present, while in others there was a tendency towards the formation of alveoli. Areas of recent hemorrhage and blood pigments within macrophages were seen in the fibrous tissue surrounding these structures. Cellular infiltrates consisting mostly of lymphocytes were likewise seen in the fibrous tissue. (Figs. 3–5.)

The diagnosis was kidney with clear cell carcinoma.

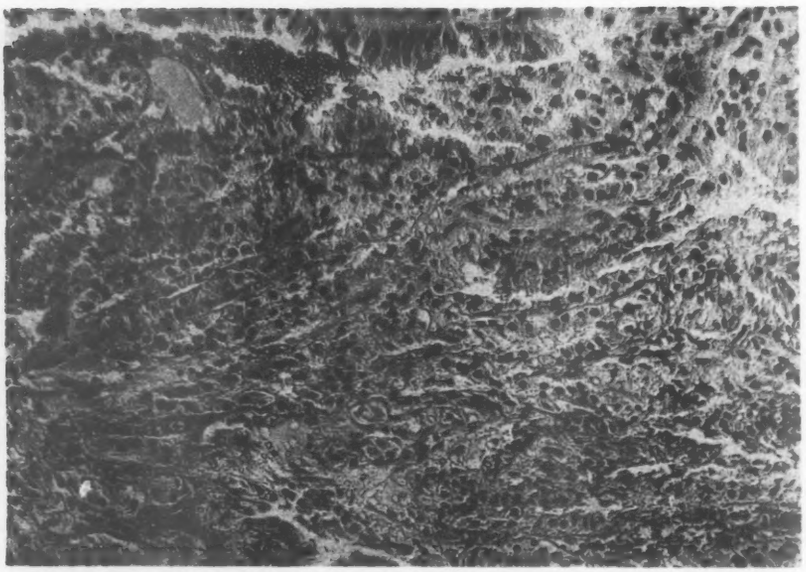

FIG. 4. The tumor as seen under medium high power, shows the cells arranged in papillary structures with a thin, supporting fibrous stroma. Original magnification, × 350.

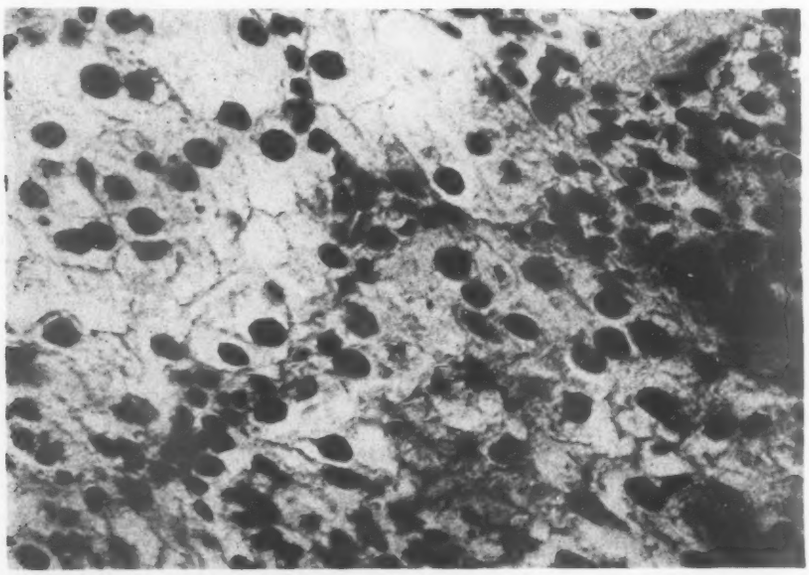

FIG. 5. The tumor as seen under high power is composed of cells that are large, with abundant, pale, foamy to clear cytoplasm, and small, hyperchromatic nuclei. In some areas, the cells are smaller, with slightly denser, granular, acidophilic cytoplasm. Original magnification, × 550.

The occurrence in children of the type of renal cell carcinoma seen in adults is quite rare. Reviewing the cases of renal neoplasm seen at the Childrens' Hospital in Boston, Ladd [1] reported that in 1938, not a single case of hypernephroma had been encountered in the previous twenty years. Melicow [2], in a review of 199 cases of renal tumors, found none in patients under thirty years of age. Cathcart [3] found one case, a child of fourteen years of age, in a review of 367 cases of renal tumors seen at the Mayo Clinic. Hempstead, Dockerty and Logan [4] added another case from the same clinic in 1953. Scotti [5] reviewed the files of the New York Post-Graduate Medical School and Hospital and found three cases of hypernephroma in children. Two cases of renal cell carcinoma and three of papillary adenocar-

cinoma were described by Johnson and Marshall [6] in a report from the Childrens' and Western Pennsylvania Hospitals. Single additional case reports were presented by Hellstrom [7], Beattie [8], and Currie [9]. Bell [10] was so impressed by the rarity of this type of tumor in children that he expressed doubt as to its occurrence, believing that such tumors were variants of the Wilm's type of growth. With this thought in mind, a careful search was made of all the sections of the tumor removed from the patient presented in this report, in an attempt to relate it to a Wilm's tumor. However, no satisfactory evidence to substantiate such a relationship was found. The variegated microscopic picture of this tumor has its counterpart in the renal cell carcinoma found in adults which also frequently presents such an appearance.

In an attempt to explain the infrequent occurrence of hypernephroma in children, Hempstead et al. [4] postulated that these tumors may have their origin in adenomas of the kidney which, as a rule, represent degenerative changes in the kidney and hence do not begin to appear until later in life. This theory could easily be applied to the present case, since, apart from the areas of clear cells which serve to identify the essential nature of the lesion, the microscopic appearance strongly suggests a mixed adenoma, which may have been the precursor of the carcinoma.

Acknowledgment: We would like to thank Drs. D. Grayzel and E. Ferriol of the Department of Pathology, Jewish Hospital, for their descriptions of the pathologic material.

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Fat Embolism in Childhood

REVIEW AND CASE REPORT

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FAT embolism is a frequent complication of trauma, usually not serious, yet occasionally fatal and frequently undiagnosed. Despite extensive studies and reviews, its presence is not usually suspected and its pathogenesis is not proved. It is rare in childhood, only six such cases being mentioned in the recent literature in comparison with hundreds of adult cases [*1–6*]. A report of a fatal case of fat embolism occurring in a seven year old girl following a supracondylar fracture of the humerus is presented here, together with a brief review of the general subject to emphasize the need for being aware of its possible presence.

INCIDENCE

Fat emboli are frequently found in the lungs at postmortem examination in a wide variety of conditions, such as following injury to bone and soft tissue, severe burns, influenzal pneumonia, severe infections and toxic states, shock, surgical operations, crushing injuries, diabetes, childbirth, poisonings, alcoholism, inhalation anesthesias, anoxia and simulated high altitude flights. The most common occurrence is in the fourth decade of life and males, being more subject to trauma, are affected in the ratio of eight to one. The decreased incidence in children has been explained by the fact that up to the age of fourteen years the fat content of the bone marrow is low, with a greater proportion of the higher melting fats, palmitin and stearin, and less of the fluid fat, olein [*6*].

ETIOLOGY

It has been generally considered that oily fat from bone marrow is forced by the tension of a fracture hematoma directly into the circulation, and many observations support this theory. Although fat is normally present in the circulating blood, only those particles larger than 8 microns behave as emboli. Denman and Gragg [*7*] have suggested that some chemical change occurs in the blood or in the blood fat, which causes a demulsification and coalescence of the chylomicrons into globules of sufficient size to obstruct capillaries. They conclude that several factors are involved including mobilization of fat from injured areas and a change in the physical state of the blood fat due to alterations in body metabolism and chemistry produced by either trauma or disease. Johnson and Svanborg [*8*] minimize the probability of bone marrow as a source of fat and suggest that fat emboli are probably a symptom of a qualitative change of the serum lipids, as part of a complex of symptoms comprising shock, tissue injuries and a change of the emulsification of the serum lipids. Whatever the pathogenesis, microscopic examination of the lungs of dead subjects reveals the presence of fat particles in the capillaries of the alveolar walls and in the edema fluid of the alveolar spaces along with petechial hemorrhage and occasional bronchopneumonia. These particles are found in the brain, liver, heart and in the glomerular capillaries of the kidney. Some believe that irritation produced by the emboli results from the breaking up of the fat into its component fatty acids [*6*]. However, Denman and Gragg [*7*] and Warren [*9*] show that the emboli are neutral fat and not hydrolyzed. Pulmonary edema and anoxia are considered the usual cause of death. Cardiac decompensation secondary to increased resistance in the pulmonary capillaries plays a part. Gauss [*10*] states that about one-fourth of the patients die from cerebral damage and show an excessive involvement of the brain.

DIAGNOSIS

The signs and symptoms of fat embolism are frequently obscure, but they usually divide

themselves into one of two forms, cardiorespiratory or cerebral. Following a latent period, the symptoms begin suddenly or gradually in a few hours or after several days. First, there is a striking change in the patient's general condition, with a rise in temperature. There may be a sudden or progressive restlessness, pain in the chest and slight dyspnea. Cyanosis, increased pulse rate and a normal blood pressure are usual. The pulmonary symptoms are cough, cyanosis, dyspnea, restlessness with pulmonary rales and pulmonary edema, which may show on x-ray examination. The cerebral symptoms are restlessness, disorientation, loss of sphincter control and deepening coma. There may be tonic or clonic convulsions. Petechiae may be seen on the eyelids, neck and chest. There is usually no headache, nausea or vomiting, or papilledema, which differentiates it from increased intracranial pressure of trauma to the brain.

Laboratory studies which may confirm the clinical diagnosis are examinations of the urine, sputum and circulating blood for fat globules as well as roentgen examination of the lungs. The demonstration of free fat in the urine, the bladder having been completely emptied, is diagnostic of fat embolism; there will be some false negatives and false positives, but it is a practical and reasonably accurate test. The presence of fat in the sputum is unreliable because of the high incidence of false positives. Dark field examination of the whole blood for fat globules as well as the gross turbidity of plasma are the diagnostic procedures suggested by Swank and Dugger [*4*]. An accurate method of detecting fat emboli in the blood by the use of a water soluble fluorescent fat stain phosphin 3R, has been described by Peltier [*11*].

TREATMENT

Prevention consists of careful manipulation and satisfactory mobilization of fractures, the use of a tourniquet during operation on fatty marrow, and the avoidance of shock, anoxia, overeating and fat solvent anesthetics. No thoroughly effective treatment has been found but therapy should be directed toward treatment of shock, cerebral edema and anoxia with emphasis on oxygen, blood and electrolyte requirements. Herman [*12*] found that intravenous administration of dextrose and alcohol mixture was effective in relieving the symptoms and reducing blood fat in the capillaries of the lungs. Barbiturates are used to prevent and control convulsions. Use of the Levin tube for gastrointestinal drainage, low fat feedings with constant nursing care, antibiotics, intravenous calcium gluconate, parenteral vitamins and nicotinic acid may prove helpful. Surgical measures are tourniquets, venous ligation, evacuation of the fatty hematoma at the site of injury and adequate immobilization. Drugs such as pituitrin,® caffeine, coramine,® morphine and insulin have been suggested because they produce a steady decline in the level of blood fat. Theoretically, emulsifying agents should be effective, but none have proved satisfactory up to the present time. Choline chloride was used experimentally by Monson and Dennis [*13*]. The judicious administration of heparin was suggested by Swank [*4*] to dissolve the fat responsible for fat embolism; however, Becker, Bowman and Grossman [*14*] found experimentally that heparin increased the mortality.

CASE REPORT

On August 13, 1954 a seven year old obese child fell while playing and injured the region of the left elbow. She was brought directly to the Delaware County Hospital, and was admitted to the accident room at about 5:30 P.M. Physical examination, in the accident room, revealed no abnormalities other than generalized obesity and a supracondylar fracture of the left humerus.

Using open drop vinethene inhalation anesthesia, closed reduction of the fracture of the left humerus was attempted. The obesity, local swelling and type of fracture made reduction extremely difficult. After several attempts of closed manipulation and traction, a partially satisfactory reduction was obtained and posterior plaster splint and immobilization applied. Postreduction x-ray films, through the plaster, revealed good alignment of the fracture fragments in the lateral position, but still some radial displacement of the distal fragment which looked as though it would not hold its position. The child was admitted to the children's semiprivate division of the hospital at 9:15 P.M. of the same day for further reduction of the fracture on the following day. A thorough history was obtained from the mother and a physical examination performed. Chicken pox, measles and mumps were the only previous illness other than frequent sore throats. The

appetite was always good, with a tendency toward overeating. The child responded to painful stimuli, but had not fully recovered from the anesthesia. On examination, she appeared pale; the lips were cyanotic, but the pulse was regular and of good quality. As the examination progressed, the child recovered slightly from the anesthesia and was cooperative, but in much pain. Examination of the heart revealed a normal sinus rhythm, with no murmurs. Throughout both lungs there were scattered rales and rhonchi, which were attributed to recent inhalation of anesthesia. The left upper extremity was immobilized with the elbow in flexion by a posterior molded splint, bound to the chest. The left radial pulse and respirations were recorded hourly during the night and they averaged 110 and 38, respectively. At 1 A.M. on August 14, she voided involuntarily. At 7:30 A.M. without having completely regained clear consciousness, although she was able to answer questions following the anesthesia, there was a generalized clonic-tonic seizure involving the right side more than the left. Respiration rose to 65 and the pulse to 150 per minute. The temperature was 102°F. by axilla.

On examination, the skin was mildly cyanotic with mottling over the abdomen. The eyes were constantly moving. Corneal reflexes were present bilaterally. The pupils reacted to light. Papilledema was questionably present in the left eye. There was generalized hypertonicity of all muscles. Gag reflex was present, and the tongue appeared in the midline. Over the chest were coarse breath sounds with rales in the lower lobe. Abdominal examination was negative. The liver and spleen were not palpable. Knee and abdominal reflexes were absent.

The laboratory studies showed the following: Hemoglobin, 11.7 gm. per cent. (75 per cent); red blood cells, 4,510,000 per cu. mm.; white blood cells, 19,000 per cu. mm.; stab forms, 22 per cent; segmented neutrophils, 72 per cent; and lymphocytes, 6 per cent.

Urinalysis showed an acid reaction; a specific gravity of 1.020 and a trace of albumin. Sugar was negative. There was a trace of acetone and diacetic acid was negative. There were 3 to 5 white blood cells, occasional epithelial cells, and mucus was 2 plus.

The blood culture showed no growth on the second day or after ten days of incubation. Blood sugar showed 135 mg. per cent. It was repeated six hours later and reported as 94 mg. per cent. The carbon dioxide combining power was 49 volumes per cent and when repeated later was 34 volumes per cent. Blood chlorides were 600 mg. per cent, urinary chlorides were 10 mg. per cent.

A lumbar puncture was performed revealing clear fluid under pressure of 65 mm. of water; 14 cc. were removed in which the cell count was 100 per cu. mm., white blood cells, 2; red blood cells 98. The differential count showed 2 lymphocytes. Total protein of the spinal fluid was 24 mg. per cent; sugar, 85 mg. per cent. An examination of stained smear of the fluid revealed no organisms and a culture produced no growth.

Treatment consisted of nasal oxygen and oxygen in a cooled tent. Fifty per cent glucose solution and sodium amytal were given intravenously for the original convulsive seizure. Depoheparin® (Upjohn), 1 cc., was administered intramuscularly. Parenteral fluids consisted of 500 cc. of 10 per cent glucose in water, 1000 cc. of 5 per cent glucose in water and 500 cc. of lactate Ringers solution by clysis. One ampule of vitamin B complex was added to each intravenous bottle. Dilantin,® 1½ gr., was given rectally.

The respirations rose to 98 per minute and the temperature to 106°F. by axilla. The pulse had risen to 160 but came down to 128 per minute. The patient died at 8:15 P.M. on the day following admission. The autopsy showed the lungs to be markedly congested with extensive secondary alveolar hemorrhage. There were many dissolved fat globules in the vessels and alveoli which were proved by fat stain. The brain showed extensive and marked congestion with small extravascular hemorrhage. Fat emboli were demonstrated by fat stain. The liver, spleen and kidneys were congested. The thymus and lymph nodes were hypertrophied showing lymphoid hyperplasia. The remaining organs were normal. The diagnoses were fat embolism of lungs and brain, thymus hypertrophy and splenic hypertrophy.

SUMMARY

A case of fatal fat embolism in a seven year old obese child is presented. Reports of this condition in children are rare, but the incidence is probably much higher than recorded statistics would indicate and the physician should be alert to its possible presence.

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We recommend:

Textbook of Pathology. With Clinical Applications. By Stanley L. Robbins, M.D., Associate Professor of Pathology, Boston University School of Medicine. 1,351 pages, 933 illustrations, with references and an index. Philadelphia, 1957. W. B. Saunders Co. (This work was written for students and clinicians. It differs from the usual texts in both the organization of subject matter and in the treatment of individual chapters. Each chapter covers (1) outline of lesions; (2) the "normal"; (3) major pathology; (4) a summary corollation of pathology with the resultant clinical problems. Decidedly worthwhile.)

Surgery: Principles and Practice. By J. Garrott Allen, M.D., Professor of Surgery, University of Chicago; Henry N. Harkins, M.D., PH.D., Professor of Surgery, University of Washington School of Medicine; Carl A. Moyer, M.D., Bixby Professor of Surgery, Washington University School of Medicine; and Jonathan E. Rhoads, M.D., D.SC. (Med.), Professor of Surgery, University of Pennsylvania School of Medicine and Graduate School of Medicine. Thirty-two contributors. 1,494 pages, 623 figures, with references and an index. Philadelphia, 1957. J. B. Lippincott Co. *Price* $16.00. (Highest recommendation.)

Obstetrical Nursing. By Carolyn Conant Van Blarcom, R.N. Revised by Erna Ziegel, R.N., B.S. Fourth edition, 855 pages, 205 figures; bibliography and student references at chapter endings, with a glossary and an index. New York, 1957. Macmillan Co. *Price* $6.50.

Congenital Absence of the Septum Pellucidum

A REVIEW OF THE LITERATURE WITH CASE REPORT

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THE unusual occurrence of the encephalographic picture associated with "congenital" absence of the septum pellucidum has prompted us to review the literature with the idea of summarizing our knowledge and recording the second case seen by one of us (D. L. R.) [1]. Thirty-three cases in which air studies revealed characteristic features of the abnormality were surveyed. In addition, references to twelve pertinent autopsy cases were reviewed. (Table 1.)

ANATOMY

The septum pellucidum is a thin, double-walled partition which lies in the mid-saggital plane between the two lateral ventricles and is attached to the corpus callosum and fornix. Lowman and co-workers [2] mention its width as varying between 0.2 and 0.3 cm., and that its height measures 0.9 to 1.5 cm. Comparative anatomy has been described by Young [3]. A comprehensive discussion of acquired and developmental anomalies is found in the work of Puusepp [4].

HISTORY

Canossi and Pasquinelli [5] noted that Turner [6], in 1878, was the first to observe anatomic absence of the septum pellucidum. Two years later Tenchini [7] described the finding at autopsy on the brain of a two and a half year old boy who was said to be mentally normal. Subsequently, Hochstetter [8] found two examples in fetal brains, one of which had hydrocephalus. Numerous authors have described absence of the septum in association with absence of the corpus callosum. Other anomalies reported as associated with this defect include: spina bifida (Alexander and Such [9]), porencephaly (Alexander and Such), tuberous sclerosis (Savin [10] quotes Berkwitz and Rigler [11]), syringomyelia (Puusepp mentions Vercelli [12]), bilateral amaurosis (Reeves), anophthalmia (Hojman [13]), microcephaly, and agenesis of the fornices or olfactory bulbs (Canossi, Pasquinelli). General agreement holds that the defect is not associated with a specific clinical picture or symptom.

Sfintzescu and Mihailescu [14] cited a case recorded by Forster [15] in 1933 in which the septal defect was noted on an encephalogram. One year later Bannwarth [16] reported four cases in which the anomaly was demonstrated by encephalography. Unfortunately, confirmation of the x-ray picture at autopsy leaves something to be desired. No autopsy reports were found among any of those cases in which the encephalogram showed the classic picture.

INCIDENCE

Ryndin [17] was quoted by Puusepp as estimating that this anomaly occurs in one of 1,000 brains. He gave no more information. Autopsies have been reported as revealing the defect in a three-month fetus and a seventy-four year old man. Encephalographic demonstration has been made in a three day old male as well as a fifty-five year old man. The occurrence of the picture alone without evidence of hydrocephalus or other abnormality of the brain is the exception.

ROENTGEN CHARACTERISTICS

Encephalographic characteristics of absence of the septum pellucidum were noted in 1935

TABLE 1

CONGENITAL ABSENCE OF THE SEPTUM PELLUCIDUM

Reference	Summary	Roentgen Findings
Turner, 1878	According to Canossi and Pasquinelli [5] the author reported the first anatomic observation of absence of septum pellucidum	.....
Tenchini [7], 1880	2½ yr. old boy, mentally normal, died with tuberculous meningitis; ab. s.p.* postmortem examination	.....
Hochstetter [8], 1925	Postmortem: adult brain normal except for ab. s.p.; 2 fetal brains with ab. s.p., 1 of which had hydrocephalus	.....
Hahn, Kuhlenbeck [19], 1930	Postmortem: brain of unknown origin with ab. s.p. and no other anomalies	.....
Forster [15], 1933	Sfintzescu mentions author observed this anomaly but ignored congenital eticlogy	Pneumoencephalogram, ab. s.p.
Alexander and Such [9], 1934	Puusepp notes authors found ab. s.p. in 10 day infant with hydrocephalus and spina bifida; also found in 11 mo. old child with hydrocephalus, porencephaly and meningitis	.....
Bannwarth [16], 1934	As cited by Zellweger and Von Muralt [28]: (1) 2 yr. old idiot; (2) 10 yr. old (details?); (3) 11 yr. old idiot; (4) 28 yr. old (details?)	All on pneumoencephalagram, ab. s.p.
Dyke and Davidoff [18], 1935	23 yr. old woman with postencephalitic behavior disorder; physical examination normal	Pneumoencephalogram, ab. s.p.; no other anomalies
Berkwitz and Rigler [11], 1935	Savin [10] says authors demonstrated lesion in 2 yr. old girl with tuberous sclerosis	Pneumoencephalogram, ab. s.p.; moderate ventricular enlargement
Basu and Bhupendra [20], 1935	Puusepp reports authors "found case in perfectly healthy normal individual." (Presumably at postmortem)	.....
Sfintzescu and Mihailescu [14], 1936	.....	Ventriculogram, ab. s.p.
Kötter [21], 1936	20 yr. old patient with pseudosclerosis after encephalitis in infancy (mentioned by Zellweger and Von Muralt [28])	Encephalogram, ab. s.p. (details not available from reference)
Dolgopol [22], 1938	60 yr. old woman with general weakness; postmortem: thrombosis of axillary and femoral arteries with incidental ab. s.p. and moderate hydrocephalus	.....
Breitenfeld [23], 1938	Puusepp [4] mentioned the author found ab. s.p. in an epileptic	Air study(?) with ab. s.p.
Ryndin [17], 1939	Ab. s.p. reported as quoted by Puusepp [4]	Air study(?) with ab. s.p.
Bannwarth [24], 1939	27 yr. old woman with epilepsy, with slightly increased deep tendon reflexes on left	Encephalogram, with ab s.p.

*NOTE: Ab. s.p. = absence of the septum pellucidum.

TABLE 1 (*Continued*)

CONGENITAL ABSENCE OF THE SEPTUM PELLUCIDUM

Reference	Summary	Roentgen Findings
Vercelli, 1940	Puusepp [4] mentioned case of 29 yr. old with ab. s.p. in presence of syringomyelia and dilated ventricles; postmortem(?)	.....
Reeves [1], 1941	7 mo. old white male with bilateral congenital amaurosis, optic atrophy, strabismus, nystagmus	Pneumoencephalogram, ab. s.p. with mild hydrocephalus
Puusepp [4], 1942	(1) 27 yr. old Estonian man, mentally retarded, with left-sided convulsions; left central facial paresis, with deviation of tongue to left and hemisensory disturbance and hyperactive deep tendon reflexes; died after encephalography (2) 24 yr. old woman with epilepsy, with congenital ptosis and facial paresis on left	(1) Ventriculogram, ab. s.p. and hydrocephalus (2) Encephalogram, ab. s.p.
Savin [10], 1946	13 yr. old Negro boy with headache and left internal strabismus	Pneumoencephalogram, ab. s.p. with moderately dilated ventricle
Foster and Windholz [25], 1948	(1) 55 yr. old man complained of impaired vision after spilling paint on face; physical examination: impaired coordination and gait (2) 3 yr. old girl with febrile convulsions and retarded development (3) 28 yr. old man with petit mal 1 yr. and congenital absence of digits 3, 4, left hand	(1) Encephalogram, ab. s.p., asymmetric dilated lateral ventricles, underdevelopment of optic thalami (2) Encephalogram, ab. s.p., lateral ventricle somewhat increased (3) Encephalogram, ab. s.p. with slight internal hydrocephalus
Schonenberg [26], 1950	(1) Mentally retarded epileptic with strabismus; 4 yr. old illegitimate child (2) 3 day old male with contusion of scalp at birth, sacral myelocele with paraparesis and sphincter involvement, died at 10 mo. No postmortem examination	(1) Encephalogram, ab. s.p., dilated ventricles (2) Encephalogram, fusion enlarged ventricles; areas devoid of skull
Hojman [13], 1952	3 yr. old boy, full term spontaneous delivery with cyanosis at birth; syncope at 2½ yr.; anophthalmia; no active movement; hypertonic; electroencephalogram, irregular alpha	Pneumoencephalogram, ab. s.p.
Canossi and Pasquinelli [5], 1952	6 mo. old microcephalic male, icteric at birth; general convulsions at 1 mo.; physical examination: hepatosplenomegaly and hyperactive deep tendon reflexes	Encephalogram, ab. s.p. and large cavity in left hemisphere
Ravelli [27], 1952	Referred to 41 yr. old man with abnormality on air study	Encephalogram, ab. s.p. with moderate hydrocephalus
Zellweger and Von Muralt [28], 1952	(1) 2 yr., 8 mo. old girl, with acrocephalosyndactilism with convulsive disorder starting at 2½ yr. (2) 3 yr., 3 mo. old girl with spastic right hemiparesis (3) 5 yr., 4 mo. old boy with nystagmus, strabismus, optic atrophy, left, positive toe signs (4) 11½ yr. old boy with spastic hemiparesis, unilateral convulsions since 9 yr. of age (5) 20 yr. old woman with convulsive disorder, left spastic hemiparesis	(1) Pneumoencephalogram, ab. s.p. (2) Encephalogram, enlarged left lateral ventricle, ab. s.p. (3) Encephalogram, enlarged lateral ventricles, ab. s.p. (4) Encephalogram, ab. s.p. (5) Encephalogram, enlarged lateral ventricles, ab. s.p.

TABLE 1 (*Continued*)

CONGENITAL ABSENCE OF THE SEPTUM PELLUCIDUM

Reference	Summary	Roentgen Findings
Martischnig and Thalhammer [29], 1952	1 mo. old male infant with acrocephalosyndactilism	Pneumoencephalogram, ab. s.p.
Durand and Brusa [30], 1953	2 yr., 5 mo. old girl, mentally retarded, with clinodactyly, talipes valgus, single transverse palmar crease	Pneumoencephalogram, ab. s.p.
Rebollo [31], 1954	2½ yr. old boy, mentally retarded with disturbance of speech and gait; right 3rd cranial nerve paresis, right facial palsy, Babinski sign on right	Encephalogram, slight enlargement of ventricles and porencephalic defect, right frontal; ab. s.p.
Davidoff and Epstein [32], 1955	(1) 74 yr. old man with normal neurologic examination died with arteriosclerotic heart disease; ab. s.p. at postmortem examination	.....
	(2) 26 yr. old woman, premature birth; convulsive disorder at age 26 yr.; neurologic examination negative	(2) Pneumoencephalogram, ab. s.p.; asymmetry of lateral ventricles, normal in size
St. John and Reeves, 1956	19 yr. old girl with epilepsy, amaurosis, spina bifida occulta	Pneumoencephalogram, ab. s.p. with mild hydrocephalus

by Dyke and Davidoff [18] as follows: "in the anteroposterior and posteroanterior views the lateral ventricles appeared confluent medially. The usual linear vertical shadow produced by the septum pellucidum was absent. At the midline ventrally there was a nipple like projection from the ventricles." They pointed out the similarity in the picture produced by absence of the septum and that seen in certain cases with perforation of the septum.

CASE REPORT

L. L. D., a nineteen year old unmarried white girl, was admitted to the Santa Barbara County Hospital on February 12, 1951, for a diagnostic pneumoencephalogram to complete investigation of periodic lapses of attention and inability to respond vocally or to control behavior. The patient thought these spells had occurred for three years.

A satisfactory family and birth history were not obtained. The patient had been told that she was blind since birth. Childhood illnesses included measles and sore throats. A tonsillectomy had been performed when she was nine years of age. Recurrent episodes of backache had occurred since the age of ten years. An automobile accident sustained in childhood was responsible for a scar on the scalp; the patient had not lost consciousness.

General examination revealed an alert, sociable and cooperative white girl appearing younger than her stated age. Enlargement of the head suggested hydrocephalus. Light perception was absent in both eyes, and the pupils did not react to light. Vitreous floaters were seen in the right eye; the optic disc was atrophic; degeneration of the choroid and retina was noted. Inspection of the left eye revealed ectasia of the cornea; the iris was adherent and degenerated in color. The lens, vitreous and retina could not be visualized.

Neurologic examination revealed no other involvement of the cranial nerves. The patient's gait was somewhat spastic. (No disturbance of sensory function was mentioned.) The deep tendon reflexes were accentuated. No pathologic toe signs were demonstrated.

Routine examination of the blood and urine revealed nothing remarkable. Serologic tests for syphilis were negative. An electroencephalogram was reported as "diffusely abnormal . . . and suggestive also of a lowered convulsive threshold." Roentgenograms of the skull revealed no evidence of abnormality except for an unidentified calcification noted in the pos-

FIG. 1. Normal pneumoencephalogram, anteroposterior view, showing lateral ventricles separated by septum pellucidum.

teroanterior film study opposite the left orbital area. X-rays of the spine showed lumbar scoliosis and a marked kyphosis centered in the mid-dorsal region. Also noted were congenital laminal defects at L4 and L5, and "a spina bifida at S-1."

A pneumoencephalogram performed under sodium pentothal® and local anesthesia revealed symmetric filling of slightly enlarged lateral ventricles which were normal in position and shape except for confluence and absence of the usual shadow projected by the septum pellucidum in the anteroposterior view. (Figs. 1 and 2.) Lateral views did not reveal the oft-mentioned coma-shaped shadow caused by confluence of the lateral ventricles in the region of the septal defect. Presumably rotation of the head accounted for absence of this finding noted in other cases. The third ventricle as seen in the anteroposterior view was small and in the midline. The fourth ventricle was not seen.

The impression was: convulsive disorder associated with congenital absence of the septum pellucidum and mild hydrocephalus as demonstrated by pneumoencephalography. Other abnormalities noted included atrophy of the right optic nerve, staphyloma with degeneration of the left eye, both of unknown origin, and a spina bifida occulta at S1.

COMMENT

As in other reported cases of absence of the septum pellucidum, multiple developmental anomalies of the nervous system coexisted here.

FIG. 2. Case 1. Pneumoencephalogram, anteroposterior view, showing confluence of slightly enlarged lateral ventricles resulting from absence of the septum pellucidum.

The defect is best demonstrated in the anteroposterior view of the encephalogram and is not necessarily associated with the so-called coma-shaped shadow often noted in the region of the septal defect on the lateral views.

SUMMARY

1. A case of absence of the septum pellucidum diagnosed by pneumoencephalography is presented.

2. Forty-five cases of this defect are reviewed; pertinent information is summarized and tabulated.

3. The abnormality is not associated with a definite clinical picture or symptom.

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Superficial Phlebitis of the Breast

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SUPERFICIAL phlebitis of the breast, or Mondor's disease, is an unusual condition which apparently occurs more frequently than is reported because of its self-limitation and minimal symptomatology. In the past, patients have probably disregarded the cord-like lesion which usually occurs in the breast area, but with the layman's present day awareness of cancer, more of these patients are seeking medical consultation.

The presence of a lump or cord in the breast with skin fixation, a characteristic feature of this disease, demands that malignancy be ruled out. This case presents some of the interesting facets of this disease and is reported to add to the number already collected in the literature. The frequency with which this lesion is coming to attention justifies that every physician examining a breast be aware of it.

CASE REPORT

G. N., a thirty-four year old Negro housewife, was first seen in The Ohio State University Cancer Clinic on October 1, 1956. She had been in apparent good health until two weeks prior to her initial visit when, while bathing, she noticed a lump in her right breast. The lump allegedly increased in size during the ensuing two weeks, and was slightly tender and painful. She had menstruated one week before the lesion was found; this was the first such lump noted by the patient. There was no recent history of trauma, infection, febrile episode or malaise. Her appetite was good, weight stable, and her general well-being and activity were excellent.

General physical examination revealed no abnormalities, except for positive findings confined to the right breast. On its lateral aspect, a firm, tender mass was felt which measured approximately 4 mm. by 6 cm. It was superficial and adherent to the skin. By retracting the breast medially (Fig. 1), a cord of tissue could be made to stand out like a bowstring. The left breast and regional lymphatic areas, bilaterally, were normal.

FIG. 1. When the patient's left hand retracts the breast medially, a cord of tissue appearing as a bowstring comes into prominence on its lateral aspect.

A preoperative diagnosis of Mondor's disease was made and no biopsy thought necessary. However, because of our interest in this lesion, the patient's anxiety and to be absolutely certain that it was not malignant, a portion of the lesion was excised under local anesthesia. The pathologic report confirmed our preoperative

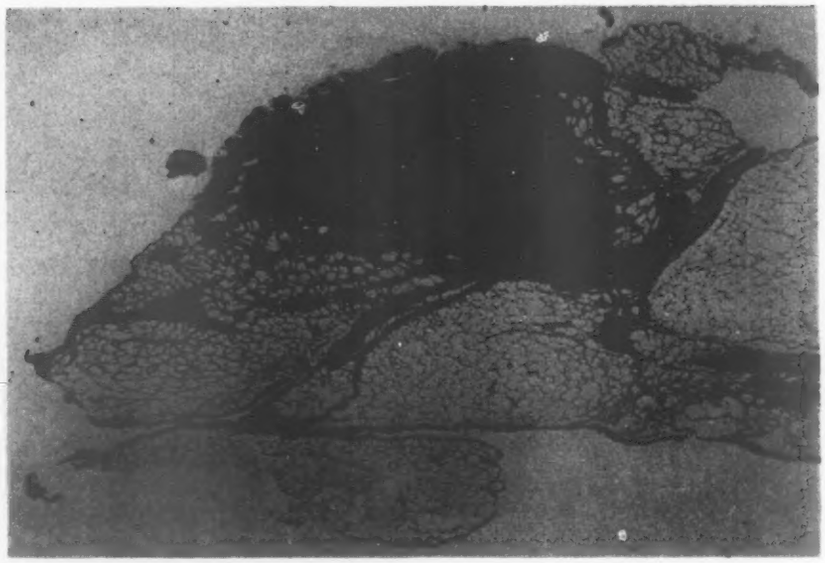

FIG. 2. A high power magnification showing the marked fibrous perivascular inflammation in the subcutaneous tissue of the breast. (Department of Photography, Ohio State University.)

diagnosis of superficial phlebitis of the breast. Her postoperative course was uneventful, and the incision healed with no complication.

COMMENTS

The eponym, Mondor's disease, became popular after Henry Mondor published his report of four cases in 1939 [*1*]. He called this condition a "string phlebitis of the breast" [*2,3*]. Farrow's review on the subject [*4*] in 1955 noted that only fifty-eight cases had been reported in the world literature, and that twenty-four of these occurred in males. Kaufman [*5*] added seven more cases in 1956, and mentioned that the appellation, Mondor's disease, was not accurate because there were prior descriptions of the syndrome [*6–9*].

The first report of superficial phlebitis of the chest was probably the case described by Fagge [*10*] in 1869, who believed that the cord-like thickenings with skin fixation were scleroderma bands. Since that time occasional reports have appeared in the literature. The etiology has been ascribed to various causes, including scleroderma, inflammation in an embryonic milkridge (vestigial mastitis) [*11*], trauma and effort [*12,13*], and idiopathic and postoperative phlebitis [*14*].

Previous investigators have believed that this lesion represents a sclerosing periangiitis [*15*] or phlebitis, which usually affects the lateral thoracic vein or thoracoepigastric vein. Histologic sections of the lesion confirm that it is a sclerosing endophlebitis. Differentiation between an arteritis and phlebitis is difficult at times, but the paucity of elastic fibers and the small, thin ring of smooth muscle cells surrounded by a perivascular cuff of thick, fibrous, inflammatory tissue (Fig. 2) suggest that it is venous in origin.

Mondor's disease has occasionally been mistaken for a malignant lesion in the breast. The cord was interpreted as consisting of a lymphatic permeation of neoplastic cells [*16*]. The reason for its consideration in differentiating it from a malignancy in the breast is its frequent fixation to the skin. Atkins [*17*] has stated that the most important sign in differentiating a benign from a malignant lesion in the breast is to note whether skin fixation has occurred. Adair [*14*] reports that the following lesions in the breast may produce skin attachment: pyogenic infection, cysts, traumatic fat necrosis, plasma cell mastitis, intradermal tumors such as neurofibromas and sebaceous cysts, and an occasional intracanalicular fibroadenoma in contrast to a periductal fibroadenoma, which is freely movable and without skin attachment. Finally, he included thrombosis of the superficial veins of the breast, the majority of which occurred following operative procedures on the breast.

The characteristic physical finding of this condition is a round 3 to 5 mm. in diameter,

tender, painful sinuous cord of variable length in the subcutaneous tissue and fixed to the skin. By elevating or retracting the breast, the cord can be made to stand out like a bowstring. Axillary lymphadenopathy is not a common finding, but may occur as a reactive hyperplasia to the localized inflammatory process.

The disease occurs in an otherwise healthy person who suddenly notices a tender, painful mass or cord, usually somewhere along a line from the anterior axillary fold to the epigastrium. There may be a history of recent trauma, muscular strain or pre-existing respiratory infection [6]. Antibiotics and anticoagulants are not indicated, inasmuch as the disease tends to be self-limited and resolved without treatment within several months.

SUMMARY

1. A case report of superficial phlebitis of the breast, or Mondor's disease, is presented.

2. This lesion may occasionally be mistaken for a malignancy because of the frequency of skin fixation. It is self-limited and resolves without treatment.

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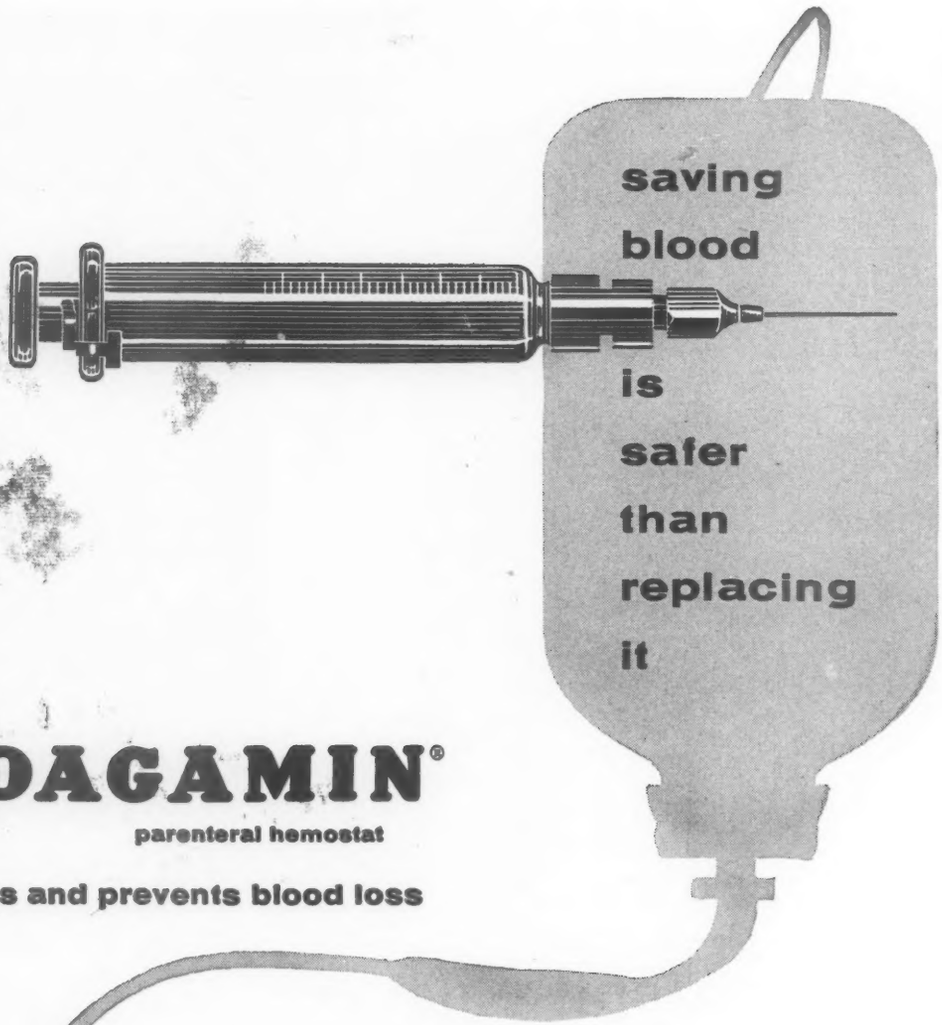

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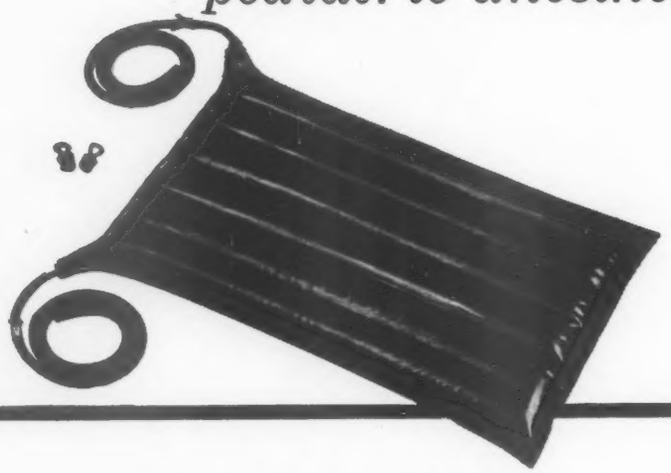

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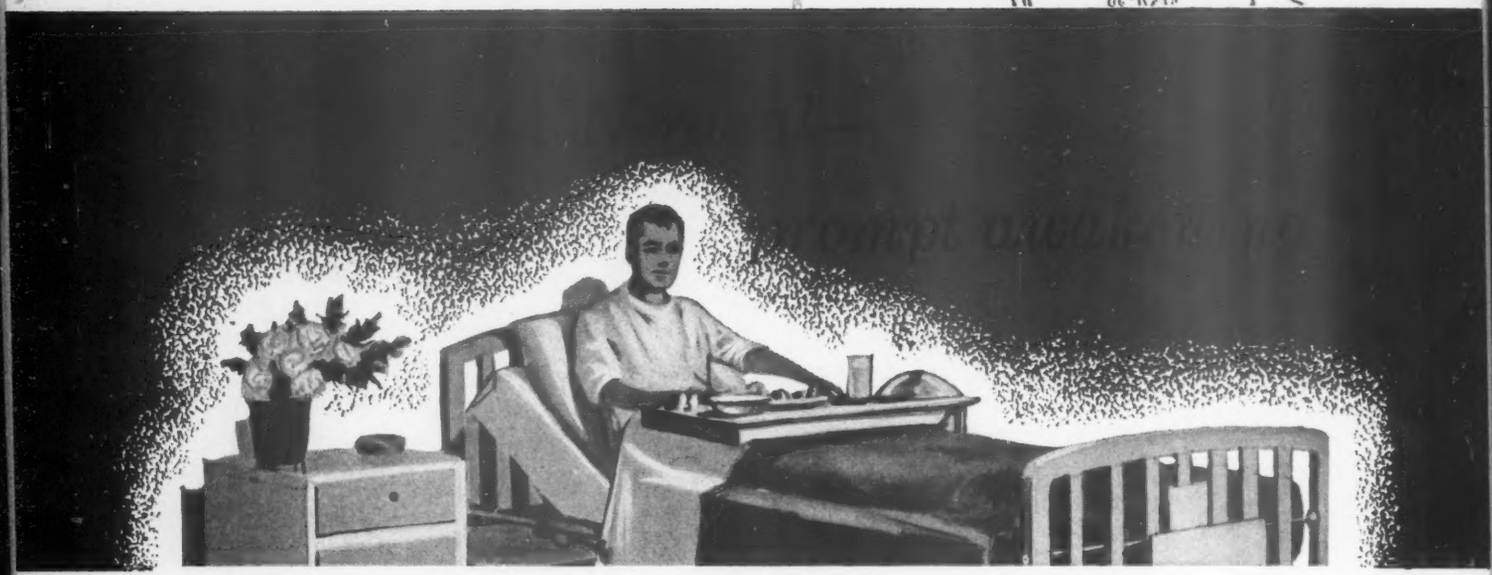

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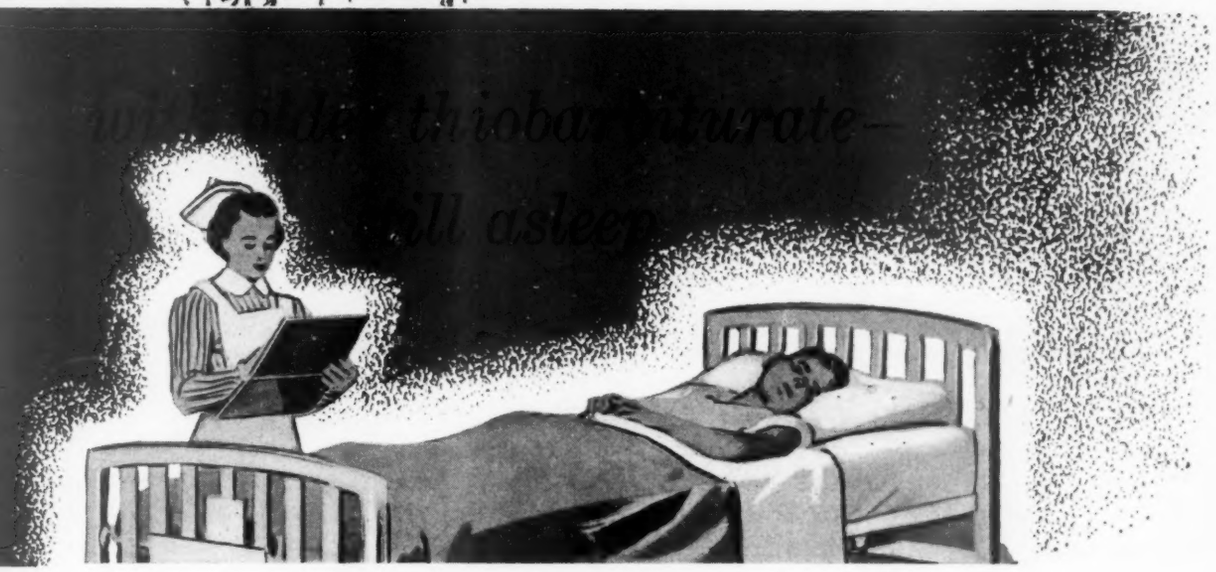

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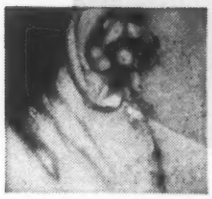

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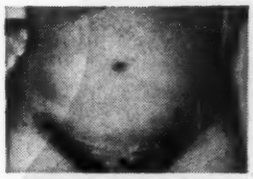

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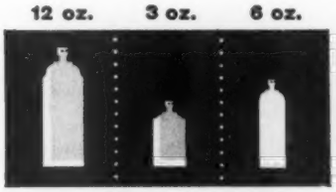

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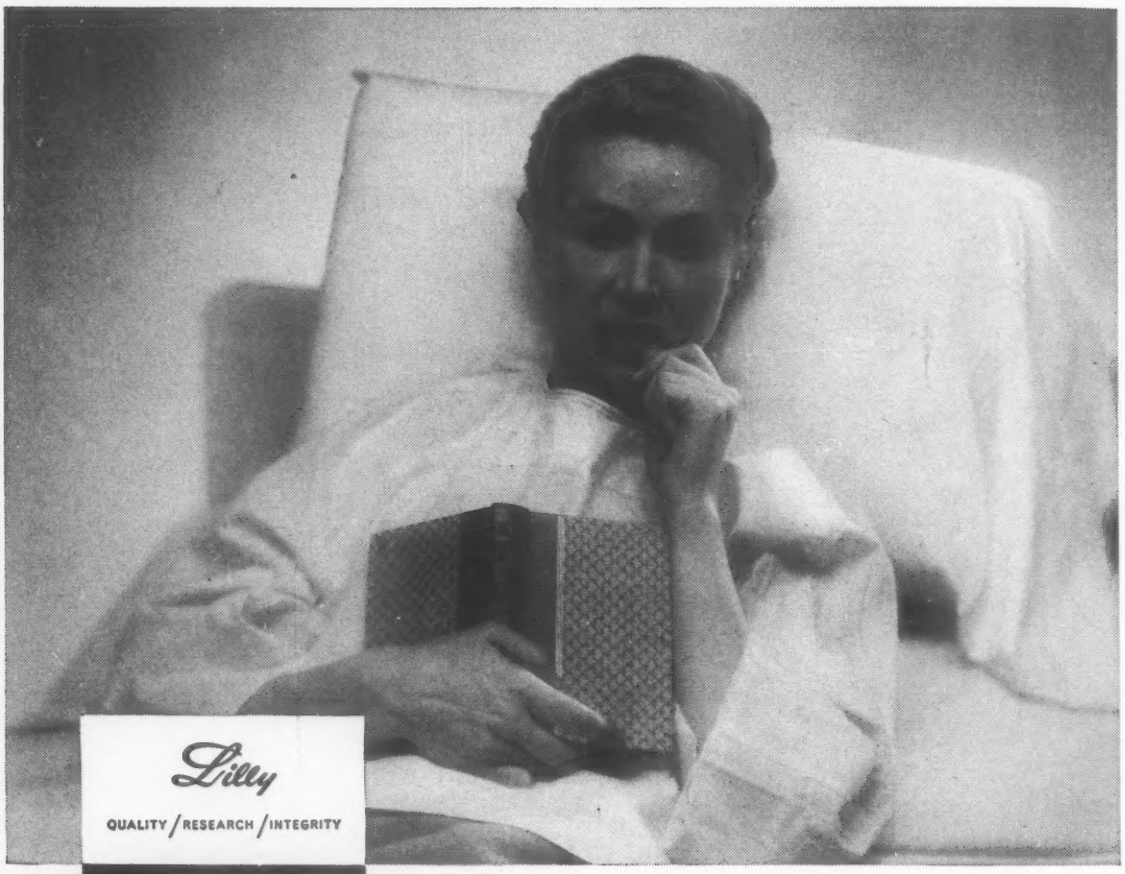

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1. Flocks, R. H.: J.A.M.A. *163*:709 (Mar. 2) 1957.
2. Flocks, R. H.; Marberger, H.; Begley, B. J., and Prendergast, L. J.: J. Urol. *74*:549, 1955.

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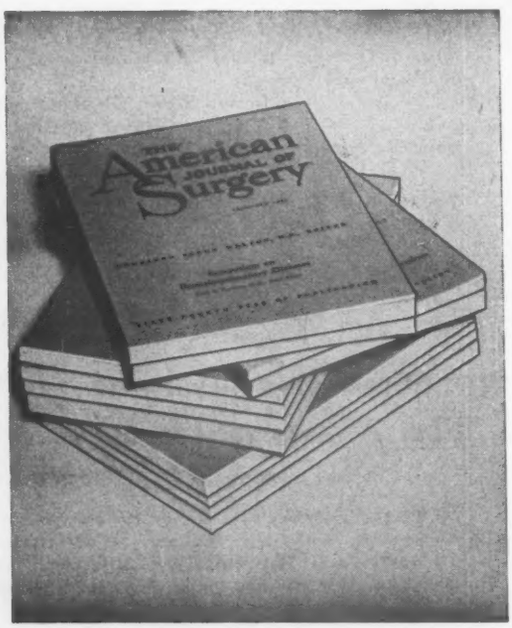

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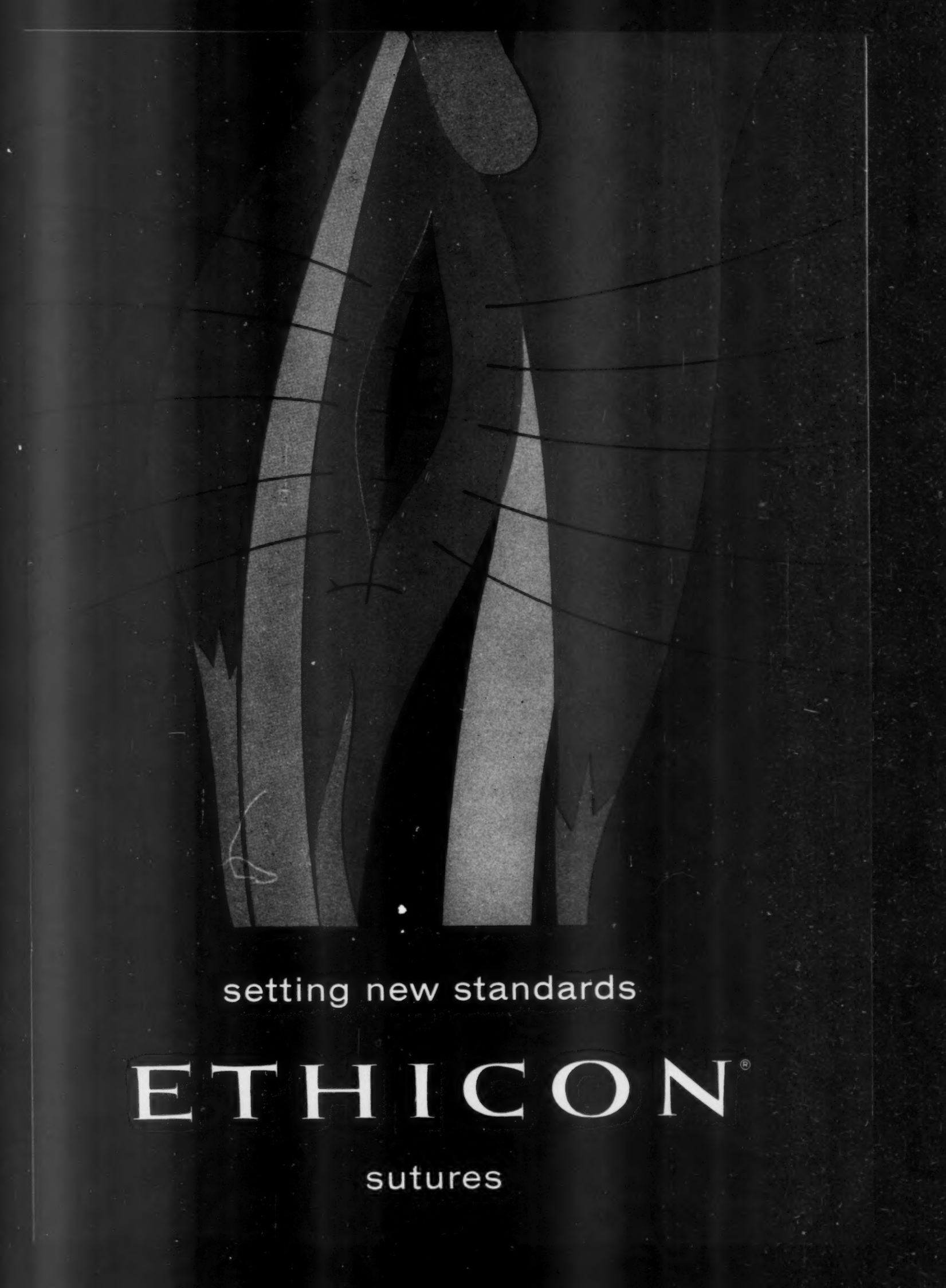
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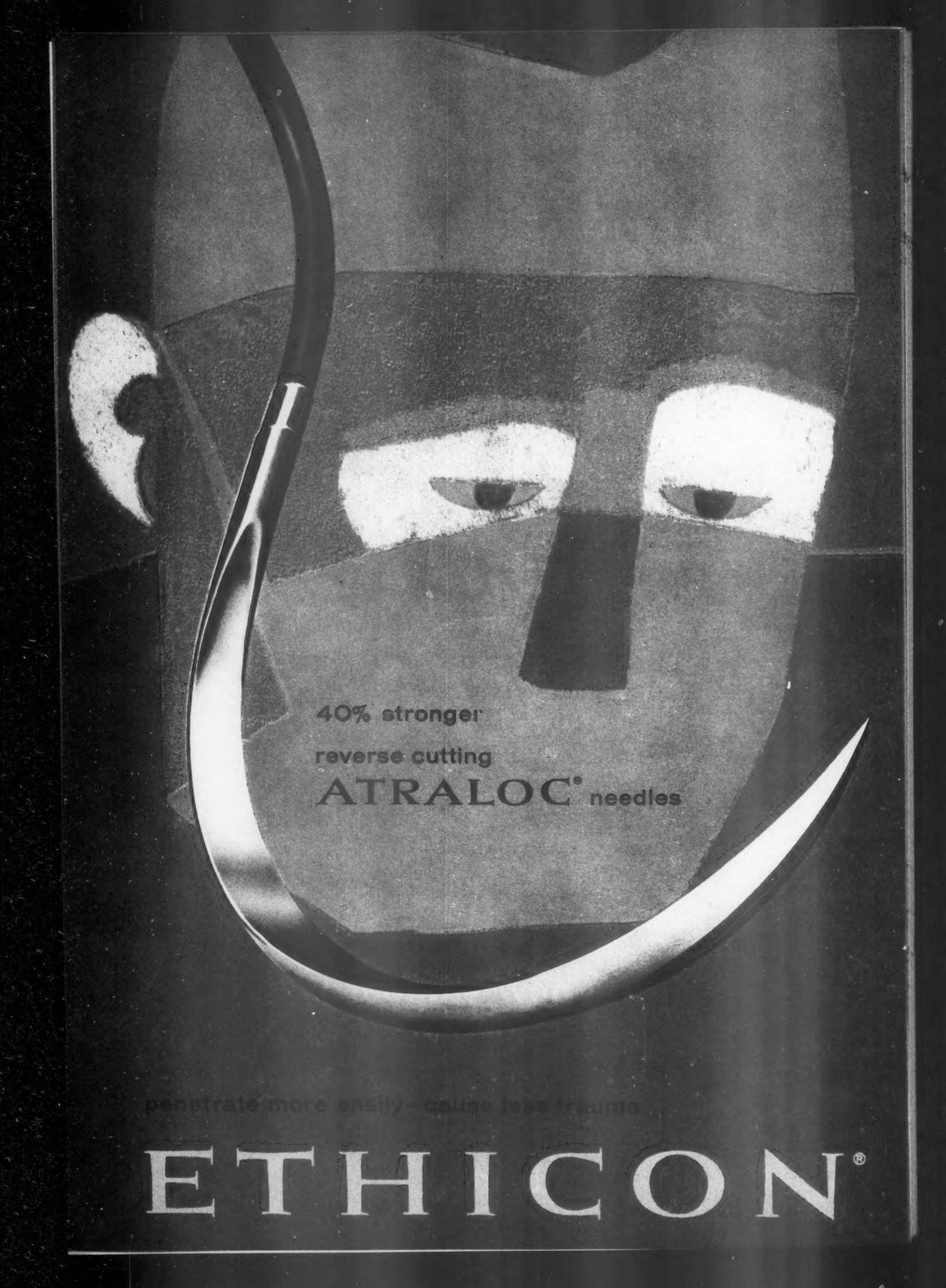
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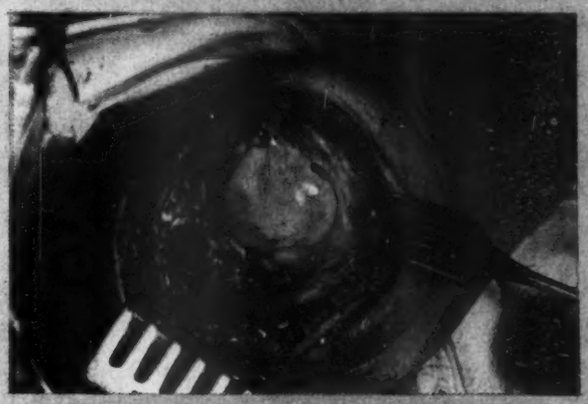
2. Skin draped. Saber incision outlined at acromion.



3. Acromion denuded of cartilage. Shoulder capsule opened.

4. Acromial process of the scapula osteotomized.
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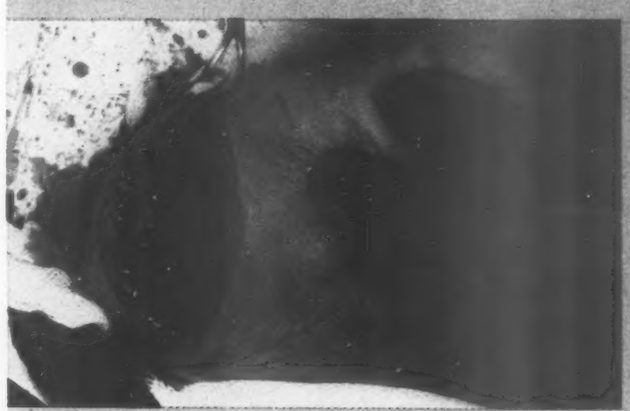
5. In succession: Flap is osteotomized in head of humerus; cartilage is denuded from head of humerus, which is joined to acromial process.

6. Acromial process now in head of humerus.



7. Cuff of shoulder capsule reefed to scapula.

8. Wound closed and prefitted cast applied.

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NOTES AND QUOTES

A COLOR x-ray viewer system that increases the readability of x-ray pictures through the use of contrast enhancement and color TV technics has been developed by Philco Corporation.

The Philco "Exicon" x-ray viewer system performs three essentially different, but equally important, functions to extract quickly and accurately a maximum amount of information from an x-ray transparency, according to Dr. J. Gershon-Cohen, Chief of Radiology of the Einstein Medical Center, Northern Division, Philadelphia. Dr. Gershon-Cohen, who has been in close contact with Philco, Government and Industrial Division, research engineers during the development of the "Exicon" x-ray viewer, said that the system "enhances x-ray contrast in 'gray scale' variations, increases readability by utilizing full color and magnifies an area being viewed."

Dr. Gershon-Cohen, a recognized authority in the field of radiology, went on to explain that the human eye, like the majority of senses, responds to stimuli on a relative or percentage basis. For example, the eye will recognize an area of a picture as being brighter than a neighboring area, provided there is a certain brightness differential. "Important information contained in a small area of low contrast x-ray negatives is frequently difficult to discern by the usual visual process, even to a trained technician," he commented. The Philco "Exicon" x-ray viewer, however, provides electronic contrast enhancement and displays x-ray areas of equal optical density in the same color. Areas having differential optical density are reproduced in other colors such as blue, cyan, green, yellow, orange and red. Thus, opaque solutions injected into the blood system can be followed in color through the heart and blood vessels of the lungs and other organs, lending more accuracy and realism to the x-ray picture. Tissues not clearly seen heretofore will now be made visible in color. The new system consists of monochrome and color monitors, an operators' console and a flying spot scanner. An x-ray negative placed before the flying spot scanner will be magnified and separately reproduced in enhanced monochrome and color. Negatives may be quickly shifted about to obtain magnified images of any portion. The system may be used with closed circuit color TV installations.

Joseph Fisher, Philco, Government and Industrial Research Division, section engineer, pointed out that the eye does a poor job of remembering different shades of gray, just as the ear is forgetful of the intensity of sound. "Color," he added, "is quite easily remembered." "Exicon," by transforming the gray scales into corresponding varieties of color hue, permits the eye to compare not only adjacent areas of the subject matter but also separated areas. All areas of equal density in the x-ray negative are displayed in the same color. "This system should be invaluable to the medical profession for diagnosis, instruction and demonstration," he said.

The new Philco "Exicon" viewer has already attracted considerable attention in the medical profession. A prototype model is currently being demonstrated before representatives of a number of major civilian and military medical installations.

Doctors, nurses and x-ray technicians tolerate undue x-ray exposure holding the lateral x-ray cassette during operations on the hip. A simple, lightweight Cassette Holder, manufactured by Watson-Sharp & Co., West Chicago, Illinois, eliminates the hazard of contamination, incorrect positioning and motion. Hundreds of x-rays have shown that duplicate, superior, detailed lateral views are now easily obtained. The arm is pivoted from a point adjacent to the patient's shoulder to a position behind the crest of the ileum, allowing greater freedom to the surgical field. This Cassette Holder can be used on orthopedic, operating and x-ray tables.

FOR some years the surgeons of Canada have felt the need for a national journal in which they could publish their own original work. Last year the leading surgical groups in Canada met and requested the Canadian Medical Association to undertake the publishing of a quarterly *Canadian Journal of Surgery*. The Association gladly agreed to co-operate in this, and the first issue of the *Canadian Journal of Surgery* appeared on October 1, 1957. The Editorial Board consists of the professors of surgery from the twelve Canadian medical schools, with Dr. R. M. Janes of Toronto, President of the Royal College of Physicians and Surgeons of

CONTINUED ON PAGE 52

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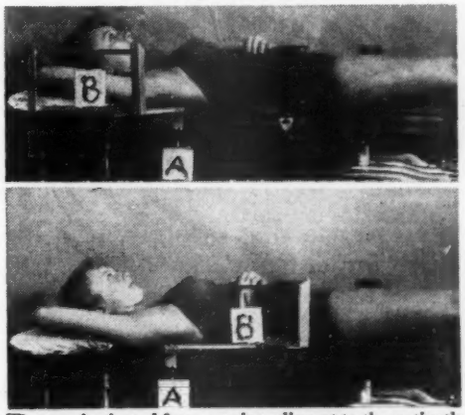

The arm is pivoted from a point adjacent to the patient's shoulder (A) to a position behind the crest of the ilium, allowing greater freedom to the surgical field.

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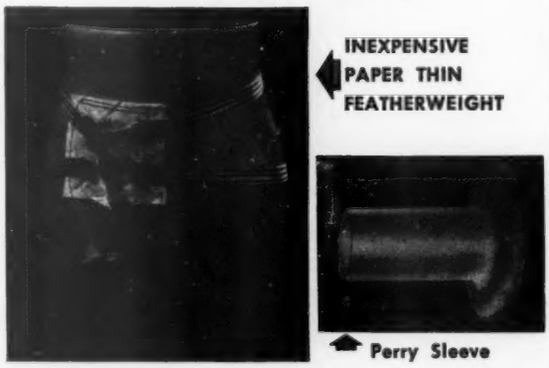

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Those planning to attend the 7th International Cancer Congress which will take place at the Royal Festival Hall, London, from July 6 to 12, 1958, are reminded that enrollment forms must be received at the Congress Office (45 Lincoln's Inn Fields, London, W.C.2) by January 1, 1958, if a late fee is not to be incurred. Registration forms may be obtained from the Secretary-General at that address.

A NEW parenteral preparation to combat iron-deficiency anemia apparently without the hazards of intravenous therapy is reported on by a specialist of the Mayo Foundation. The preparation is administered intramuscularly.

The study by Dr. Albert B. Hagedorn appeared in the *Journal of the American Medical Association* (164: 15, 1957). It deals with the treatment of adult patients ranging in age from thirty-five to seventy-three years.

Dr. Hagedorn reports imferon® (Lakeside) is "an effective iron preparation for intramuscular injection. Patients prefer this mode of administration over intravenous administration."

At the same time, Dr. Hagedorn stresses "intramuscularly given iron is preferable to intravenously given iron . . . because of the innate potential dangers of any intravenous therapy."

The Mayo specialist declares that "to date this intramuscularly given iron preparation has been found to be free from any toxic reactions, either local or systemic." This contrasts with "some minor reactions experienced with intravenously given iron," he says.

The total dose of intramuscularly given iron element in the study ranged from 750 to 2,000 mg.

Tests of a drug that shrinks the size of most goiters and does away with the need for their removal by surgery were reported by the University of Southern California School of Medicine.

Thirty-six men and women with goiters of all sizes ranging as large as a grapefruit were treated for from three to eighteen months during the last two years with a penetrating syntbetic chemical form of thyroid hormone called triiodothyronine. Some reduction in goiter size occurred in all cases.

The goiter which was as large as a grapefruit, shrank to the size of an orange. In about 25 per cent of the cases the goiter became invisible. In some cases the goiter shrank so much it could no longer be felt. A seventy-five year old woman who had suffered most of her life with a goiter pressing on her windpipe was relieved of shortness of breath and a persistent cough.

The drug was given in pill form three times a day. The treatment may take as long as six months, although obvious results can be seen in one month.

Return of the goiter is prevented by having the patient take enough thyroxine to keep metabolism normal. The thyroxine treatment must continue the rest of the patient's life.

The SC research was reported recently at the annual meeting of the American Goiter Association in New York City by Paul Starr, M.D., professor and head of the department of medicine.

A LYMPHEDEMA ARM SLEEVE to be used in cases following radical mastectomy was introduced by S. H. Camp and Company, Jackson, Michigan.

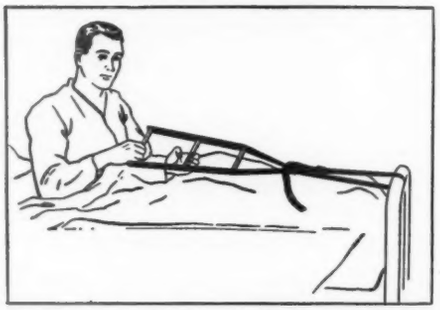
The sleeve is easy to put on or remove and is completely adjustable. The transverse stretch of Kiddie elastic aids in application. An extra mitten is provided. The sleeve is available in right and left arm sizes. It can be quickly loosened or tightened and the mitten is detachable to facilitate laundering.

If man had never gotten up off all fours and learned to walk on his hind legs, he might not now suffer from varicose veins, according to a new booklet on this ancient and widespread affliction published by the American Heart Association and its affiliates.

As the booklet points out, man's upright stance

CONTINUED ON PAGE 54

For Patient Protection



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The new Posey "Patient Aid" is another rehabilitation product which encourages self-exercise and is a positive aid to the geriatric. The patient can raise himself without calling for the nurse.
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makes it necessary for the blood in the lower extremities to flow back to the heart against the pull of gravity. In people who have inherited weak veins or whose occupation keeps them on their feet for long hours at a time (for example, housewives, policemen, elevator operators, dentists, sales clerks), the relatively thin-walled surface veins of the legs and their delicate valves are not always able to withstand the strain imposed by gravity.

The booklet emphasizes that the physician should be consulted whenever varicose veins are suspected since he can often ward off serious damage if seen in time. Many measures are now available to help minimize the bulging of the leg veins into unsightly varicosities or swellings. Such complications as swellings around the ankles, irritation of the skin, leg ulcers or sores can almost always be prevented by proper care and treatment. The booklet notes that even older men and women who would have been crippled by varicose veins a generation ago can now continue active and productive lives.

THE Part 1 Examinations of the American Board of Obstetrics and Gynecology are to be held in various parts of the United States and Canada on Thursday, January 2, 1958, at 2:00 P.M.

Candidates notified of their eligibility to participate in Part 1 must submit their case abstracts within thirty days of notification of eligibility. No candidate may take the Written Examination unless the case abstracts have been received in the office of the Secretary.

Current Bulletins outlining present requirements may be obtained by writing to: Dr. Robert L. Faulkner, Secretary-Treasurer, American Board of Obstetrics and Gynecology, 2105 Adelbert Road, Cleveland 6, Ohio.

Close to $5,000,000 has been raised toward an ultimate goal of $11,000,000 for a complete renovation and modernization of Lenox Hill Hospital, New York. Over 4,000 donors since 1954 have contributed $4,829,216.

In an analysis of the more than $4,800,000 contributed by various groups to the Second Century Development Fund, the report showed that the Hospital's trustees, medical staff and nurses gave close to $700,000. Former patients, friends and neighborhood groups contributed over $1,600,000, with foundations, corporations and estates accounting for the remainder.

Construction on the first of three new buildings being planned is already under way. Replacing the Hospital's oldest building on the corner of 77th Street and Park Avenue, the new 12-story modernistically designed unit will provide a minimum accommodation of 180 beds, bringing the total bed complement of the Hospital to 622.

COMMERCIAL SOLVENTS CORPORATION, Terre Haute, Indiana, has effected significant savings of valuable material by ventilating certain processing operations with Wheelabrator Dustube Collectors. One collector ventilates a hot air drier processing bacitracin, a drug worth several hundred dollars a pound. Previously, approximately 5 per cent of the material charged to the drier was lost to the atmosphere. Complete recovery of this material in a Dustube Collector, three shifts a day, seven days a week, makes a substantial saving. The second Wheelabrator Dustube Collector ventilates a micronizer that grinds penicillin. About 2 per cent of the material passing through the micronizer, although it is said to be 1 micron or smaller in size, is salvaged in the collector and fed right back into the batch.

Large doses of the B vitamin niacin (nicotinic acid) can reduce the level of cholesterol in the blood, an accomplishment that may play a part in preventing heart attacks. This finding is reported in The Journal of the American Medical Association *by two physicians of the Jackson Clinic, Madison, Wisconsin.*

The doctors emphasize that the reduction of high cholesterol levels may play a role in protecting patients from atherosclerosis.

The Madison physicians, Drs. William B. Parsons, Jr., and John H. Flinn, write that they are now conducting a long-range study to see whether death rates from atherosclerosis will be reduced by lowering high cholesterol levels.

Their preliminary report deals with a series of twenty-four patients given exceedingly large doses—from 3 to 6 gm. of niacin daily. The patients were told not to change their diet in any other way. Niacin is best known as the antipellagra vitamin.

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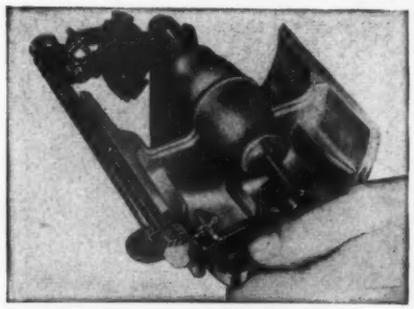

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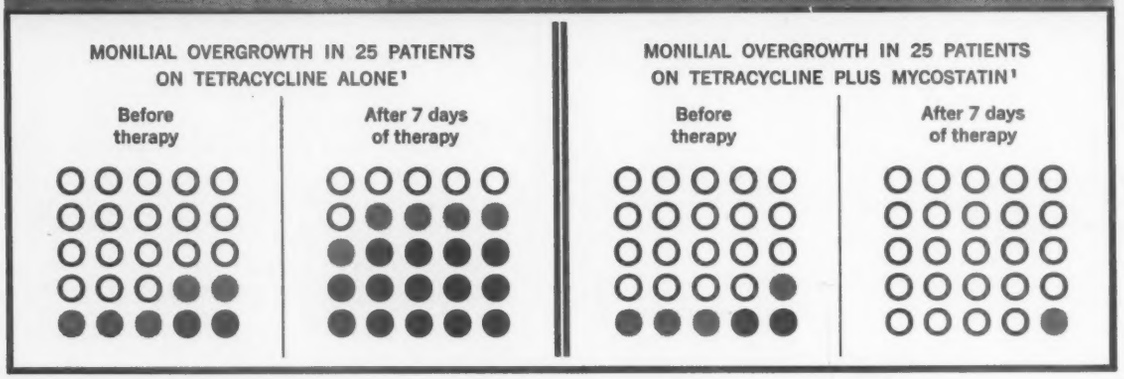

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Pediatric Drops per cc.—20 drops	100	100,000	10 cc. bottles with dropper

1. Childs, A. J.: British M. J. 1:660 (March) 1956.

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